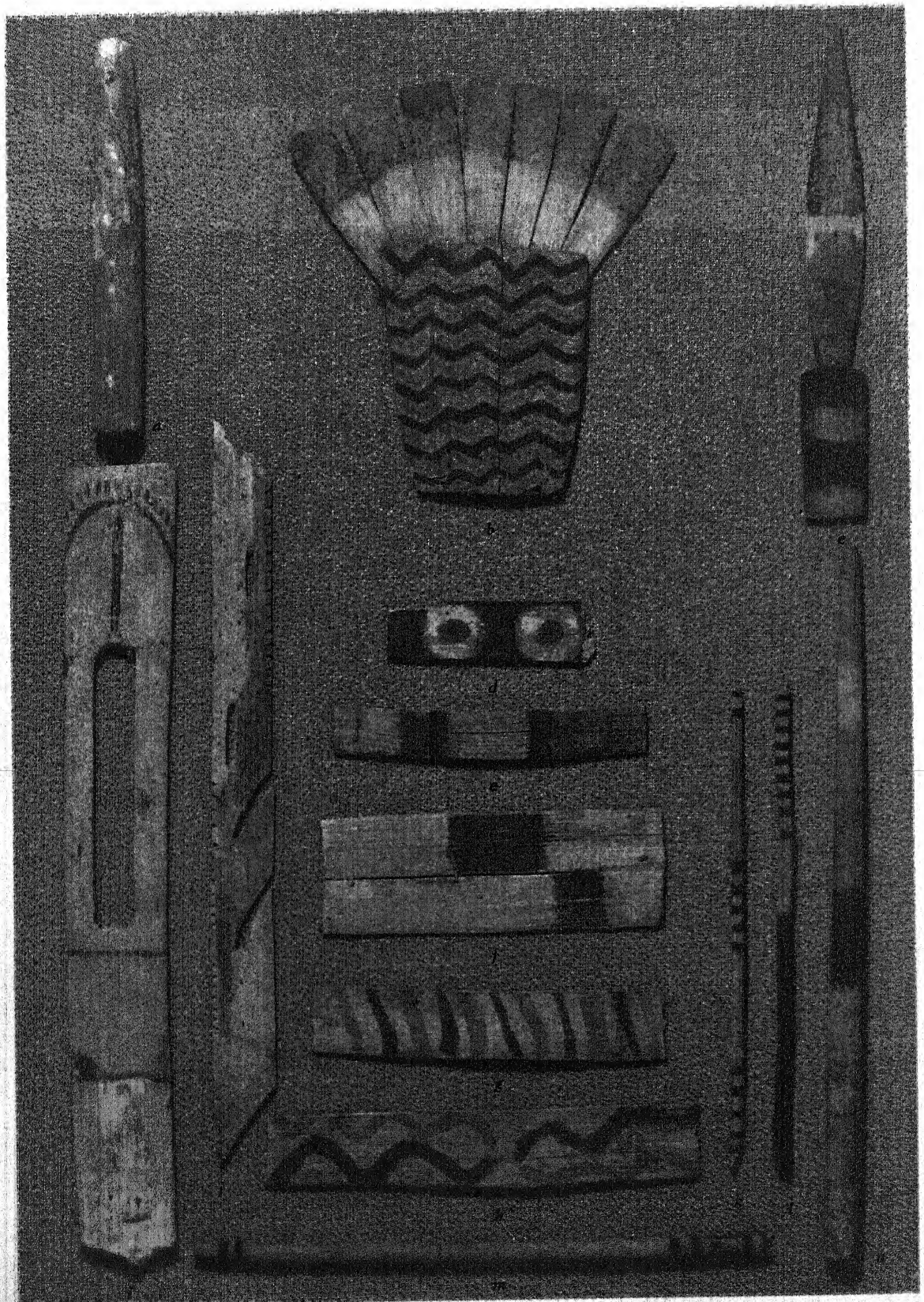
CAVES OF THE UPPER GILA AND HUECO AREAS IN NEW MEXICO AND TEXAS



FRONTISPIECE. CEREMONIAL OBJECTS. *a*, *d*, *f*, *i–n*, Steamboat Cave; *b*, *c*, *e*, Mule Creek Cave; *g*, *h*, Ceremonial Cave. *a*, *n*, painted stub pahos; *b*, wooden *tablita; c-h*, fragments of wooden *tablitas; i*, *j*, painted split-stick wands, showing sewing; *k–m*, painted sticks. (See pp. 124-26, 132-34.)

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CAVES OF THE UPPER GILA AND HUECO AREAS IN NEW MEXICO AND TEXAS

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FOREWORD

IN MOST parts of the world and for most periods, archaeologists are faced by the difficult task of visualizing the life of prehistoric peoples and of judging their competence as craftsmen on the evidence of the very few sorts of artifacts that are capable of resisting decay. The meagerness of such materials was years ago brought home most forceably to Mr. Cosgrove and me when we made what might be called a survival survey of the Peabody Museum's collection from the dry Basket-maker caves of northern Arizona. We wished to see how much of that remarkably illuminating lot of specimens would have perished in sites unprotected from the weather. We found that of the hundreds of objects, filling five large display cases and many storage drawers, there would have remained no more than a score or so of chipped flints, a handful of bone awls, and a few beads of stone and shell. The whole lot would have gone into a good-sized soup plate. That pitiful residue would have told us nothing of how the Basket-makers cradled and diapered their babies, how they dressed, how they wore their hair, what crops they grew or—what is quite as important—what plants they had not yet learned to cultivate. It would have given us no inkling of their extraordinary skill as weavers and wood-workers. As it is, we have intimate knowledge of all these and of many other details of Basket-maker life, knowledge which in the case of the overwhelming majority of ancient cultures is lost beyond recall.

Such collections as that from the Arizona caves are of enormous value, not only for the light they throw on given cultures, but also in providing bases for estimating the probable total content of those that have suffered more severely at the hand of time. It is therefore most fortunate that Mr. and Mrs. Cosgrove were able to secure, from caves in extreme southern New Mexico and in adjoining parts of Texas, another large collection of excellently preserved materials representing at least two stages of pre-Columbian development in areas previously unexplored and which, because of their position on the southern periphery of the Southwest, athwart one of the most likely routes for early migrations and for transmissions of cultural influences, are bound to become of increasing archaeological significance.

The Cosgroves' work, here reported with characteristic thoroughness and accuracy, has provided the only information we as yet possess as to the local manifestation of the early and widespread group of cultures that underlay and in many respects set the pattern for subsequent developments in the Southwest. In the caves they also made notable finds of perishable objects of the later Pueblo period, which supplement the information they had gathered in former years from the Swarts Ruin.

The early remains, evidently from the same general time horizon as those of the Basket-makers of northeastern Arizona and southeastern Utah, further illustrate that pregnant stage in the growth of all higher civilizations during which the cultivation of a cereal was fostering sedentary life, transforming nomadic hunters and gatherers of wild food-plants into settled village dwellers, providing leisure for the perfecting of arts and crafts, and bringing increase and concentration of population, which in turn necessitated the creation of workable social systems.

All civilizations, as I have said, must have passed through such a stage, for all are based on cereal crops. In Egypt, in Mesopotamia, in the Far East, in Mexico, the relentless corrosion of time has almost completely effaced the record. In the Southwest, however, it can still be read, perhaps more clearly than anywhere else in the world; and when our still scattered data are gathered together and have been added to by the further discoveries that are sure to come, we shall have not only a firm substructure for the culture history of the Southwest, but also invaluable material for interpreting the more fragmentary remains from those regions in which similar developments took place.

The first indications that the builders of the pueblos and cliff-dwellings were preceded by humbler folk were found in the 90's by the Wetherill brothers in the caves of southeastern Utah. They named these people Basket-makers, because basketry, rather than pottery, was used for mortuary offerings. Subsequent work by S. J. Guernsey, of the Peabody Museum, E. H. Morris, F. H. H. Roberts, J. L. Nusbaum, and others, has yielded remarkably complete information as to the way of life of these first farmers

of the San Juan country, and we can now follow upward in time the gradual growth of the cultures to which theirs was ancestral and which culminated in that of the Pueblo Indians.

The canyons of the San Juan and other tributaries of the Colorado are rich in the dry caves that have embalmed, so to speak, the culture of the Basket-makers. The great stretch between the San Juan and the country treated in this report contains far fewer shelters. Nevertheless, it has yielded faint but unmistakable traces of early occupancy. Only in the extreme south along the Mexican border do there again occur numerous habitable caves. From the more easterly of these, in the Big Bend region of Texas, F. M. Setzler, V. J. Smith, and others, have unearthed remains in many respects similar to those of the San Juan Basket-makers. West of the Big Bend and on into southern New Mexico, the caves worked by the Cosgroves produced still more remains, evidently akin to what has come from the Big Bend but including a certain number of objects practically identical to ones from the San Juan.

Setzler[1] calls the Big Bend people Cave-dwellers. He considers them to have been a more or less isolated or independent group and suggests that theirs may be part of a larger prehistoric culture centering in northern Mexico, especially in Coahuila. Cosgrove believes all the primitive southerners more closely allied to the San Juan Basket-makers than does Setzler, a feeling reflected in his designation of his finds as Hueco Basket-maker. The present report was completed in 1934 shortly before Mr. Cosgrove's death. His conclusions, of course, were based on comparisons of what he found with materials that had been published up to that time. It has not seemed proper to alter them in any way. The only liberty that has been taken with the original manuscript consists of certain changes in the terminology of basketry weaves and in the classification of the basketry. These were suggested by Earl H. Morris to whom, because of his unrivalled knowledge of the subject, the specimens were submitted and who generously devoted much time to their study. Had the results of his analysis and other information which has since come to light been available, it is possible that Mr. Cosgrove's opinion as to the close relationship between the San Juan Basket-makers and the southern cave people might have been modified.

[1] Setzler, 1935, p. 110.

What a thing is called is, however, relatively unimportant if one knows what one is talking about and if one presents fully and clearly the evidence on which one's opinion is based. The writings of Setzler and the Cosgroves fulfill both these requirements. The racial, cultural, and chronological relationships, not only between the early peoples of the San Juan and those of the Mexican border, but between them and the inhabitants of Lovelock Cave in Nevada, of the Ozark bluff-shelters, and of the Coahuila caves, present problems of the greatest interest and importance for New World prehistory and for the light their solution would throw on the genetics of culture and the mechanics of trait diffusion. Answers can only be had by continuance of field work of the sort done by the Cosgroves and by technological analysis as meticulous and illustration as full as theirs.

Practically all knowledge of man's prehistoric past must be derived from the material objects he has left behind him. Yet the study, on a broad comparative basis, of the material culture of the New World, after a most promising start at the hands of such men as W. H. Holmes, O. T. Mason, Walter Hough, and Erland Nordenskiöld has in more recent times suffered from the inadequate presentation, by many archaeologists, of what they have found, or from a limiting of attention to the artifacts of a single area or to some single category of specimens. And because inferences as to the meaning of ancient objects must largely be based on observation of the role similar objects play in the lives of the less advanced peoples of today, the archaeologist sometimes feels that American ethnologists have in many instances tended to stress social and ceremonial activities to the neglect of material culture.

I have often spoken, in this brief foreword, of "the" Cosgroves for, although Mrs. Cosgrove has wished the fruitful results of the excavations in the southern caves to stand as a memorial to her husband, they were the product, both in the field and in the preparation of the report, of the happiest and most complete of partnerships.

To camp with a man week in and week out, day after day to be with him on an excavation, is to know him in a way not otherwise possible. I had the privilege of being much in the field and of digging with Burton Cosgrove. His cheerfulness and his utter unselfishness under all sorts of difficulties made that association an unalloyed

pleasure. And I had opportunity to observe, in the trenches, around the campfire, and in the laboratory, his indefatigable energy, his fiercely conscientious thoroughness, and the honesty and clarity of his thinking. Those qualities enabled him to make, in "The Swarts Ruin" and in this book, two contributions which will always stand as solid stones in the very foundations of Southwestern prehistory. In his untimely passing, while at work in his beloved Southwest, archaeology lost a sound and devoted student and his colleagues a greatly valued friend.

Cambridge, 1946 A. V. KIDDER

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INTRODUCTION

THE Peabody Museum's archaeological campaign in southern New Mexico was inaugurated during the years 1924–27 by the complete excavation of a large classic Mimbres ruin on the Swarts Ranch in the Mimbres Valley. The results of that operation have been recorded ("The Swarts Ruin," by H. S. and C. B. Cosgrove). The work yielded valuable data on the architecture and burial customs of the period and produced a representative collection of artifacts, particularly rich in the beautiful Mimbres mortuary pottery. But it of course contained no specimens of cloth, basketry, or wood; and the desirability of recovering such perishable materials as these, in order to round out our knowledge of the ancient material culture, led to the cave explorations with which the present paper is principally concerned.

That caves and rock shelters containing well-preserved remains are abundant in this general region was known from the stories of early settlers and from the results of recent lootings. It was, in fact, evident that unless immediate action were taken all such deposits would be destroyed by vandals. In addition to these incentives, it was believed, because of the nature of finds made in the neighborhood and of objects from caves near Las Cruces, New Mexico, and El Paso, Texas, that there was likelihood that information might be had regarding still older cultures. Among such evidences was a piece of twined-woven fabric closely similar to that of the San Juan Basket-makers that had been discovered by the late Wesley Bradfield in a cave on the Doolittle Ranch, only 3 1/2 miles southwest of Swarts. We had also obtained an atlatl from a Las Cruces cave and seen Basket-maker-like remains from shelters in the vicinity of El Paso.

Therefore, in July, 1926, while excavation was still going on at Swarts, 2 men were taken from that work to dig for 12 days under supervision in the near-by Doolittle Cave. In October, 1927, when the work at Swarts was completed, 2 weeks were spent digging the Chavez Cave west of Las Cruces, New Mexico, after which a trip was made to the Hueco Mountains near El Paso, Texas, to look into the possibilities of the caves in that district. The month of July, 1928, was spent excavating caves in the Hueco Mountains, and during the rest of the season we explored shelters and cliff ruins in the Upper Gila country north of Silver City, New Mexico.

The year 1929 again found us northwest of Silver City, on the Gila River; later in the season at the headwaters of that stream; and, finally, in the San Francisco River drainage still farther northwest. In 1930 explorations were carried into the extreme southwestern corner of New Mexico, and again back into the San Francisco River district, where more caves had been reported. Needless to say, great numbers of shelters and caves in the cliffs showed no sign of occupation, but the eighty-nine worked at different times during the 5 years fully compensated for unproductive effort on barren sites.

No one season was entirely devoted to the exploration of caves, and the study of village ruins always occupied part of our time. Part of the survey was conducted under a permit from the Department of Agriculture, allowing the Peabody Museum's representatives to examine such ruins as might be found in the Gila National Forest. The locating and mapping of ruins and the collection of sherds, which at times necessitated some excavation, led us from patented land into the mountainous National Forest, where numbers of Pueblo village ruins, as well as caves, were found. The dry shelters, although in every instance previously disturbed, furnished evidence of a Pueblo occupation, and several of them clearly had been frequented by earlier non-Pueblo people.

Much gratitude is due the friends of the Museum, whose unflagging interest and support enabled us to broaden the scope of the investigations and thus to determine with a fair degree of accuracy the extent of the territory once controlled by the Mimbreños, and to round out the report on the excavations at Swarts by the addition of much valuable information. We are also grateful for the assistance of many personal friends in the district, among whom were Mr. and Mrs. R. B. Alves, Mrs. Gertrude W. Smith, Mr. and Mrs. Fred Woodworth, and Mr. Charles Newman, of El Paso, Texas; Dr. Floyd Caldwell, of Silver City; and Mr. Tom Pendleton, of Cloverdale, New Mexico. These kind people not only gave us word of sites, but, because of their interest in the prehistory of the section, took

time to guide us to promising ruins and, through contact with property-owners, to pave the way for our excavations.

Many thanks are due to A. V. Kidder and the late S. J. Guernsey for advice and suggestions in the study of specimens, and also to Glover M. Allen, who identified all of the food bones found in the caves. Through correspondence and consultation the following friends aided materially in clarifying obscure problems in the analysis of material herein described: E. F. Coffin, W. S. Drew, I. M. Johnston, Edgar B. Howard, F. M. Setzler, V. J. Smith, A. Wetmore, and George Woodbury.

C. B. Cosgrove

Cambridge, 1934

REGION INVESTIGATED

THE region in southern New Mexico that was investigated extends from the Arizona line as far east as the Hueco Mountains northeast of El Paso, Texas, and from the southern portions of Catron and Socorro Counties, New Mexico, to the Mexican border (fig. 1). The Upper Gila and San Francisco rivers drain via the Gila into the Pacific; the Mimbres district of Grant and Luna Counties and the Playas district of southern Grant and Hidalgo Counties form part of an interior drainage; while the Las Cruces and El Paso districts are in the Gulf watershed.

The drainage of the great upland plain, extending from Silver City well into Mexico along the eastern slopes of the Sierra Madre and embracing the Mimbres and Playas districts, has no marine outlet. The run-off from the higher surrounding mountain ranges on the north, west, and south sinks into the sands and gravels, either to form underground reservoirs or, where a compact subsoil occurs, to fill a few shallow seasonal lakes in southern New Mexico and somewhat more permanent lakes in northern Chihuahua.

Climatically and topographically the country covered falls into 2 divisions, the northern and southern, which conform, with certain overlaps, to the Upper and Lower Sonoran Zones. The former, including the rugged San Francisco, Mogollon, and Mimbres mountain ranges, has elevations of 5000 to 7500 feet with occasional peaks verging on 10,000 feet. Such peaks attract clouds, cause precipitation, and generally temper the climate. The good stands of timber, flowing water, and scenic beauty render most of this section, which is embraced by the Gila National Forest, a nature-lover's paradise. Up to the present it is unspoiled by highways and the automobile.

In the upper Mimbres country and that of the San Francisco south from Reserve, New Mexico, to its entrance into Arizona, the streams for the most part follow picturesque canyons that occasionally widen into short stretches of alluvial land upon which crops can be grown.

The southern area, as defined for the purposes of this report, is a strip of land in the Lower Sonoran Zone, 50 or more miles wide, adjacent to the International border. With elevations of 4300 to 4500 feet, it is essentially a plains country set with lone peaks or short north-south chains of mountains, some of which rise from the general level to a height of 7000 or 8000 feet. Apparently their location away from the continental backbone, and their separation from one another by broad flat valleys result in a lighter rainfall than occurs at equal elevations in the Upper Gila area. This is evidenced by the sparseness of large timber, and by the desert vegetation found along the lower slopes and in the intervening valleys. The eroded slopes and gravel mesas along the base of these mountains break off into rolling grazing land, or into extensive shallow basins, locally known as playas, which are flooded by the summer rains. These basins offered a greater acreage to the prehistoric dry farmer than was available farther north. During the heat of summer, when the country becomes brown, the shallow lakes and flood plains entirely dry up. High daytime temperatures, however, are always followed by comfortably cool nights. Lying as it does, this exposed country is subjected to strong winds, which often prevail for days at a time.

For convenience, the northern region will hereafter be referred to as Upper Gila area; the southern will be called the Hueco area, although it contains the dry shelters found in the Playas district of southwestern New Mexico and those in the foothills and mesa-rims along the Rio Grande near Las Cruces. Topographically the Playas and Huecos occupy similar settings. The low, detached western outposts of the Hueco Mountains also rise from grassy, windswept plains. More favorable is the Las Cruces country along the sheltered and fertile Rio Grande Valley.

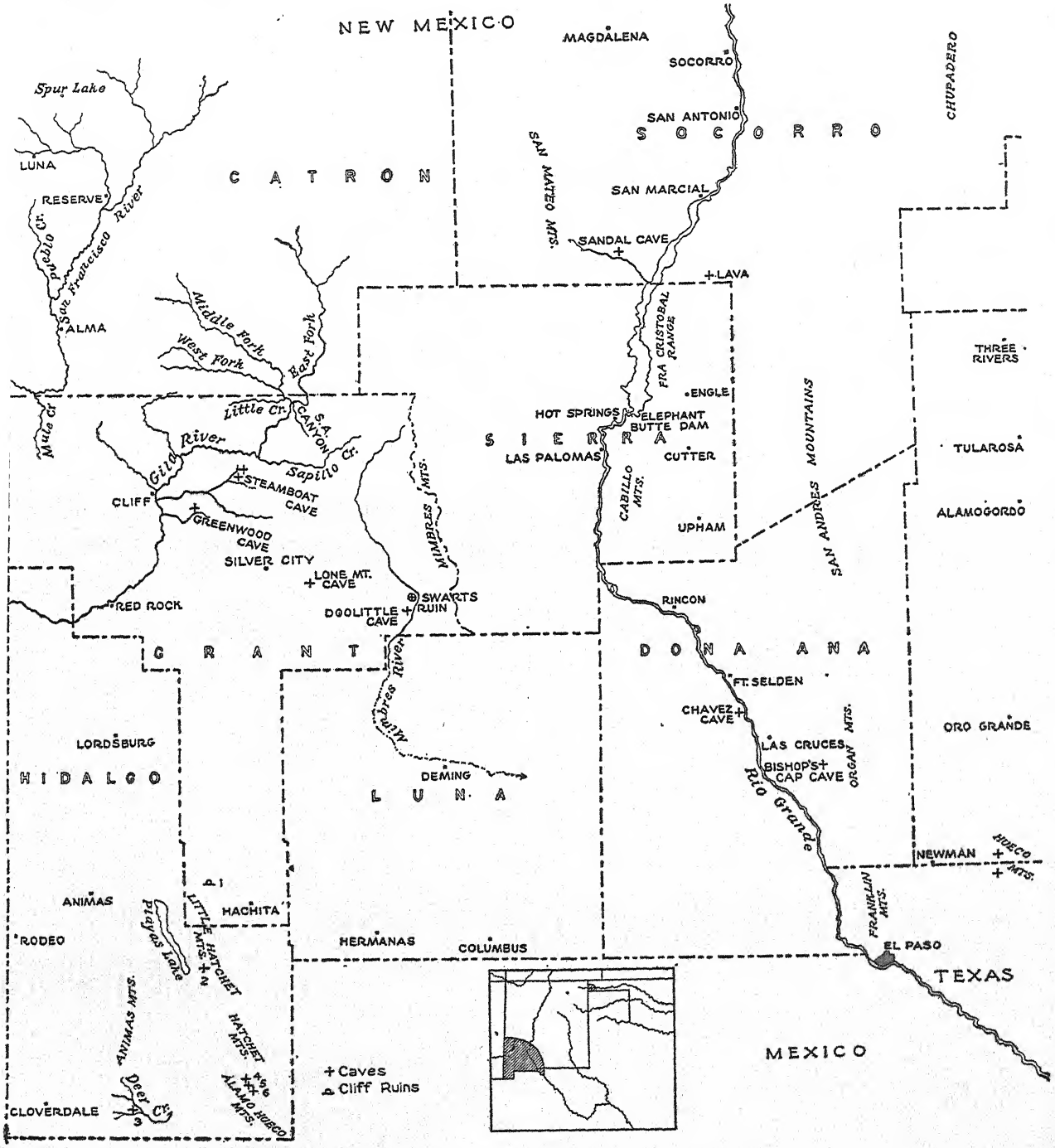


FIG. 1. Region under investigation with some of the outlying sites indicated which do not appear on the detailed maps.

FIELDWORK

UPPER GILA AREA

MIMBRES DRAINAGE

Doolittle Cave (S. W. 1/4 Sec. 9, Town. 19 S., R. 10 W., Grant Co., N. M.). The site is in a canyon tributary to the Mimbres Valley, about 3 1/2 miles southwest of the Swarts Ruin on the Mimbres River (fig. 1). Permission to excavate was given by Mrs. J. B. Doolittle, owner of the ranch, who extended every courtesy while work was carried on. The cave and some other shelters, all with western exposure, are a short distance north of the ranch house, at the top of talus, half way up a 200-foot cliff of porphyry (fig. 49, *b*), The cave proper is 42 feet long north and south and 30 feet deep at the widest point (fig. 2). The overhang sheltering some of the refuse extends out 16 feet south of the cave and disappears 57 feet down a slope below that point. The rock bottom of the cave, which has a decided outward slope, and the north end of the overhanging shelter were filled with slabs and boulders, some too large to be moved. No stratified deposits could be found, as the cave had been churned up by previous digging. Only 1 bed of ashes that might indicate a floor level was seen on the flat surface of a boulder, 18 inches below the general fill. On account of the previous digging and the work of rats, all the artifacts recovered were found 3 feet below the surface in the dirt and loose rocks. Indications of visits by Indians were encountered in the rubbish and rocks along the back wall, under the overhang, 25 feet south of the cave. These signs were in a deposit varying from 6 inches to 3 feet in depth, where it had accumulated in pockets between boulders. After fruitless digging below boulders outside, we continued excavations in the cave 1 1/2 to 2 feet below any trace of occupation, with the result that it was cleared to an average depth of 5 feet. Numbers of test holes into clean reddish soil and rocks below this level failed to disclose any burials, although there were indications of a burial (see p. 161).

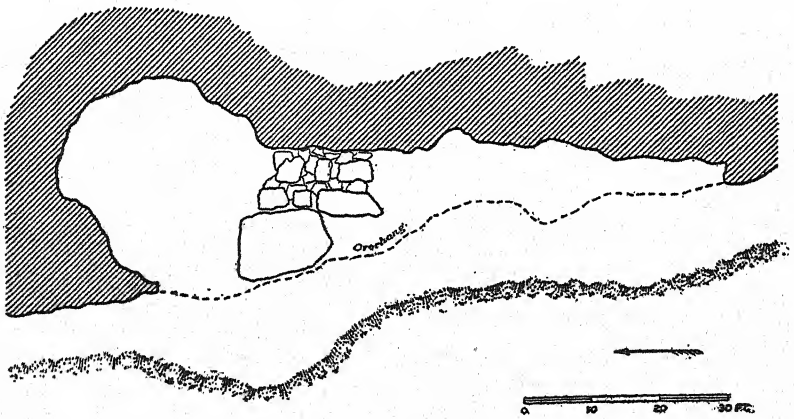


FIG. 2. Plan of Doolittle Cave, Grant Co., N. M.

When the main cave was finished, test pits were sunk in 1 shelter at the south, and 5 more to the north at a higher level along the talus. All of these gave poor results. One of the shelters was a good-sized cave 30 feet deep, but it must have served only as a camp site, since seepage of water through a hole in the roof wet the dirt fill. Lying on the floor were 3 hammerstones, a flat-faced metate, and 2 flat rocks, each showing a rubbed surface. Along the front arch of this cave were numbers of pictographs painted in yellow, red, and black (fig. 47, *h*, *1* and *4*). The colored pictographs, and 2 or 3 very dim pictographs in black in the main cave were the only examples found along the cliff.

Some trenching was done around a large boulder at the foot of a dim trail leading up the talus to the cave. Here were found quantities of Mimbres sherds, and, as in the cave itself, not a single piece of intrusive pottery. Above in the cliff deep channels indicate a previous flow of water over it, which, with seepage down the canyon in prehistoric times, may have resulted in a spring at this place. The ground is now dry, probably because floods in recent years have lowered the water table by cutting 4 or 5 feet through the soil in the canyon floor. In 1908, Mr. R. P. Boone, former owner of the Doolittle Ranch, found buried near this boulder a number of nested Mimbres bowls and a small corrugated jug containing a quantity of turqoise beads sealed with a well-fitted pottery lid. Since there were no house foundations here, the pottery and beads appear to have been offerings which were placed around what was formerly a living spring below the cave.

From the cave itself there were recovered many ceremonial objects: pahos (prayer-sticks),[1] fragments of *tablitas* (wooden ornaments for attachment to headdresses), reed cigarettes, gourd rattles, and bows and reed arrows, the latter evidently deposited as offerings. There were also numbers of worn-out sandals, all but 5 or 6 of children's sizes. That the leaving of these was some form of ritual observance seems probable, for the cave gave little other evidence of long occupancy as a place of residence. It contained, however, typical Mimbres potsherds, stone hoes, and stone tablets. The above cult material is therefore safely assignable to the Mimbres culture and adds significantly to knowledge thereof, for such perishable specimens are, of course, never found in such open ruins as Swarts. In addition to these Mimbres remains, there also came to light traces of Basket-maker occupation in the form of the proximal end of an atlatl dart, a fragment of a grooved fending stick (see p. 58), parts of Type 1*a* and 5*a* Hueco toe sandals (see p. 93), and a small piece of twined-woven cloth.[2] Thus it is evident that Doolittle Cave served as a shelter during Basket-maker times and as a Mimbres shrine.

The following is a list of the artifacts from this site:

Artifacts, Pueblo

10 large bow fragments; reed arrow shafts; 301 pointed arrow foreshafts; arrow foreshafts, notched for stone points; 3 round, rough throwing sticks; 1 complete, smooth, flattened throwing stick and 3 fragments

cotton cordage; fragment of fine cotton cloth; fragment of coarse woolen cloth; 6 fragments of cotton netting; fragment of square braid, yucca-fiber cord; fragment of cotton weft-wrap openwork

39 Type 9 sandals

basketry fragments of two-rod-and-bundle triangular foundation, fine stitch, wood-splint sewing element

painted pith object; small ball of fiber, containing tobacco (?) ; fragments of gourd rattles and handles, some painted; reed whistle; grass-stem pahos; painted twig pahos; 28 painted, 7 unpainted, and 11 unpeeled stub pahos; 2 crook ends and 9 curved fragments of crook-staff pahos; roundel-staff paho; 3 arrow pahos; 10 miniature ceremonial bows; carved and painted wooden bird

Sherds of the following types: Mimbres Rubbed Corrugated; Mimbres Classic Black-on-white; Mimbres Polychrome

fragment of painted, tubular sandstone pipe

6 complete stone hoes and 24 fragments; piece of painted sandstone; 3 stone tablets or plaques

turquoise, discoidal beads; red and white, discoidal stone beads; white and turquoise beads on cotton string; fragment of *Glycimeris* shell bracelet; bird form cut from shell; large quill with string attached

wooden gaming hoop

Artifacts, either Pueblo or Basket-maker

small corncobs, cornhusks; food bones (cottontail rabbit, jack rabbit, mule deer, pronghorn antelope, porcupine, bison, fox, coyote); herbs tied with root

fiber cordage, braided fiber cordage

48 reed cigarettes; unpeeled twig pahos; looped and knotted twigs; wooden *tablitas*

buckskin

crude projectile point; small flake scrapers, large stone scraper (retouched edge); flint flakes; stone cores; hammerstone; oval-depression metate; rubbing stones; quartz crystal

sticks showing sectioning with flint knife or saw; fire hearths and drills; 22 digging sticks; tubular wooden cylinder

bone awls; antler flaking tool

Olivella shell beads; tubular bone beads

bone dice (2 tied together)

Artifacts, Basket-maker

dart foreshaft

hair cordage; dry-dyed, twined-woven cloth, fragment

[1] Hough, 1914, p. 91.

[2] The twined-woven cloth was found by the late Wesley Bradfield.

of dry-dyed, twined-woven burden strap; 4 fragments of plain-woven burden straps, 1 with loop

Toe sandals of the following types: Type 1*a* and Type 5*a*

hinge-stick snare

stone fist axe

hair ornaments with sinew and string wrappings, 1 showing quill; large hemispherical stone bead

Lone Mountain Cave (N. E. 1/4 Sec. 27, Town. 18 S., R. 13 W., Grant Co., N. M.). The cave is east of Lone Mountain, 2 1/2 miles due west of Hurley, New Mexico, on the east side of Cameron Creek (fig. 1). Situated at the top of the talus, two-thirds of the way up a 100 foot cliff, it has a western exposure. The entrance is a narrow fissure cut through limestone by the action of water; it is 25 feet wide, with a sharp incline to the depth of 15 feet, where it enters the north end of an oval chamber at right angles to it. The chamber is 30 feet long; maximum width, 12 feet; height, 8 to 10 feet. The stone floor of the chamber is 3 to 4 feet below the surface of the dirt fill, which was damp and had rotted much of the material. The cave had been dug over by others, and we have been told that armloads of bows and reed arrows were taken from it.

From the nature of the small collection of specimens, none of which seem to be Basket-maker, it would appear that the cave was used as a shelter and hide-out as well as a depository for offerings during Pueblo times.

Artifacts, Pueblo

large and small corncobs

complete, large bow; reed arrows

2 reed cigarettes; grass-stem pahos; painted twig pahos; 3 miniature ceremonial bows; fragments of wooden *tablitas*

blackened brown-paste sherds; potter's tool made of Mimbres Bold-face sherd

Potter's polishing pebble; 2 stone tablets or plaques

board; fire drill and hearth

Glycimeris shell bracelet

GILA DRAINAGE

Greenwood Cave (N. E. 1/4 Sec. 16, Town. 16 S., R. 16 W., Grant Co., N. M.). Situated on the north side of Greenwood Canyon, an eastern tributary of the Gila River, 16 1/2 miles in a direct line northwest of Silver City, the cave is 1/4 of a mile above a box in the canyon in a picturesque cove surrounded by cliffs (fig. 1). Its exposure is southwestern. The cave is at the top of the talus, 100 feet above the stream bed, under a 100-foot perpendicular cliff. A trail around the boxed canyon passes over the cave on a bench above which a mountain rises 800 feet higher.

The finely arched entrance, 15 feet wide by 23 feet high, is in a projection, or promontory, of the cliff. The cave is 64 feet deep, with bays on the east side at front and back which give a width of 25 to 30 feet. Sloping floor and fill reduced the ceiling height to 10 feet at the rear of the chamber.

Mr. Oric Metcalf, of Silver City, who as a boy lived on a ranch near by, reports that years before, when the cave was entered by members of his family, pahos or prayer-sticks, *tablitas*, and other offerings were set up in the dirt floor. He stated that they gathered great quantities of bows and arrows, and other objects which were afterward taken to Denver. Some of these specimens must have been sent to the National Museum in Washington, as Hough illustrates bird forms and wooden plumes found by Henry and James K. Metcalf.[3]

The rather inaccessible location of the cave and the paucity of ash deposits at the front show that it was not used for any length of time as a camp. Judging from its contents, it served primarily as a Pueblo shrine. There is little or no evidence of Basket-maker occupation. The large bows and arrows, digging sticks, bundles of basketry splints, and hanks of prepared fiber were presumably offerings as doubtless were the *tablitas*, pahos, and similar articles.

Some fragmentary specimens, overlooked in the many times the cave had been dug into, were salvaged.

Artifacts, Pueblo

1 complete, large bow and 5 fragments, 1 striped red and black; arrow foreshafts; parts of reed arrows

cotton cordage; 2 types of fine cotton lace

2 bundles of basketry splints

reed cigarettes; painted twig pahos; unpeeled twig pahos; grass-stem stub pahos; 12 painted stub pahos; 3 roundel-staff pahos; 10 miniature ceremonial bows; fragments of wooden *tablitas*

[3] Hough, 1914, figs. 216, 218–20.

A cache (lying in shredded bark): small bundle of grass tied with yucca-fiber cord, circular piece of buckskin with the edge bound with yucca-fiber cord, bundle of undyed fiber and cotton cord, bundle of coarse yucca cord dyed black, large hank of prepared yucca fiber, pottery disc 2 1/2 inches in diameter (fig. 77, *c*, *d*, *g*, *h*).

Artifacts, either Pueblo or Basket-maker

small ear of corn

yucca cordage; coarse shredded yucca-leaf carrying net (full-turn coiled netting)

planting stick

Steamboat Cave (N. E. 1/4 Sec. 34, Town. 15 S., R. 15 W., Grant Co., N. M.). This cave lies 14 miles in a straight line northwest of Silver City in a cliff on the east side of a north fork of Steamboat Canyon, a tributary of Bear Creek, which empties into the Gila River (figs. 1, 51). The exposure is northwestern. Behind a single arch is the large, well-lighted Main Cave, with a more shallow bay at the south side, called South Bay. South of this is a darker and nearly circular chamber known as Bat Cave (fig. 3). The overhang is 218 feet long, with the top of the arch 70 feet above the bottom of the canyon.

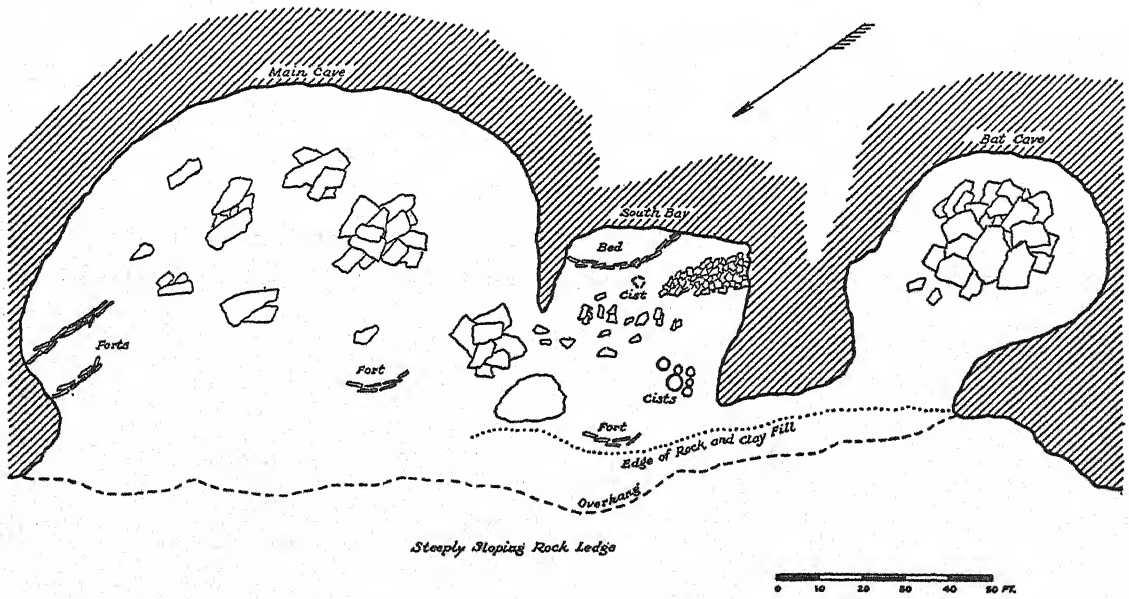


FIG. 3. Plan of Steamboat Cave, Steamboat Canyon, Grant Co., N. M.

MAIN CAVE. One hundred and twenty-two feet wide, 90 to 95 feet deep, height of ceiling at center, 30 feet; steeply sloping rock floor at back wall on level with top of outer arch.

SOUTH BAY. Forty-eight feet wide, 50 feet deep, height above fill at center, 8 feet; stone floor at back wall on level with top of outer arch, floor slopes to the south.

BAT CAVE. Width of entrance, 27 feet; width of cave, 62 feet; depth from overhang, 75 feet; height of ceiling, 25 feet; roof a perfect dome; stone floor a pocket with slope to entrance; floor at back on level with top of outer arch.

The only level ground lies in front of South Bay and Bat Cave. This is the result of a redeposit of small stones and clay in the bed of the canyon which in the past filled it 40 feet above its present level. This compact mass, now washed away in the canyon, but still remaining in the caves, rests on the sloping rock floors and stands with a perpendicular outer face 10 to 12 feet high along the entire length of South Bay and Bat Cave. The entrance to the latter is along a narrow path on top of the fill. On the sloping floor of Main Cave we found falls of very large ceiling slabs. In South Bay, because of thinner laminations in the rock formation, the slabs were evenly distributed and not so heavy. A great fall of extremely heavy slabs lay in the rear half of Bat Cave.

Because of darkness, Bat Cave has been for centuries, and is now, an ideal home for the animals after which it was named. In 1917 the cave was worked for guano, which had accumulated to a depth of 4 to 5 feet. This resulted in great damage to any specimens left there by the Indians. During these operations a large unbroken plain olla encased with a loosely woven yucca

carrying net was found in the guano. At points in Main Cave and South Bay fallen roof flags were turned on edge, forming 5 straight or rounding breastworks which would give protection to defenders, who could crouch in the depressions behind them (figs. 3, 52, *a*). In two of these, sections of trees were laid in the rocks to hold the breastworks in position and keep them from sliding. Two of them, one above the other, are at the front and extreme north end of Main Cave, and 2 more along the front at the south side. The fifth, enclosing a space 12 by 5 feet, was found against the back wall in South Bay. This had not been disturbed. Heavy mats of grass bedding found in it below the fallen rock may indicate that it was used as a protected sleeping pit instead of a fort. Small amounts of guano had accumulated in Main Cave, and probably other breastworks had been destroyed by the guano-diggers, and the rocks thrown into the canyon below. The cave as a whole was badly disturbed, and the artifacts had been tramped upon and broken.

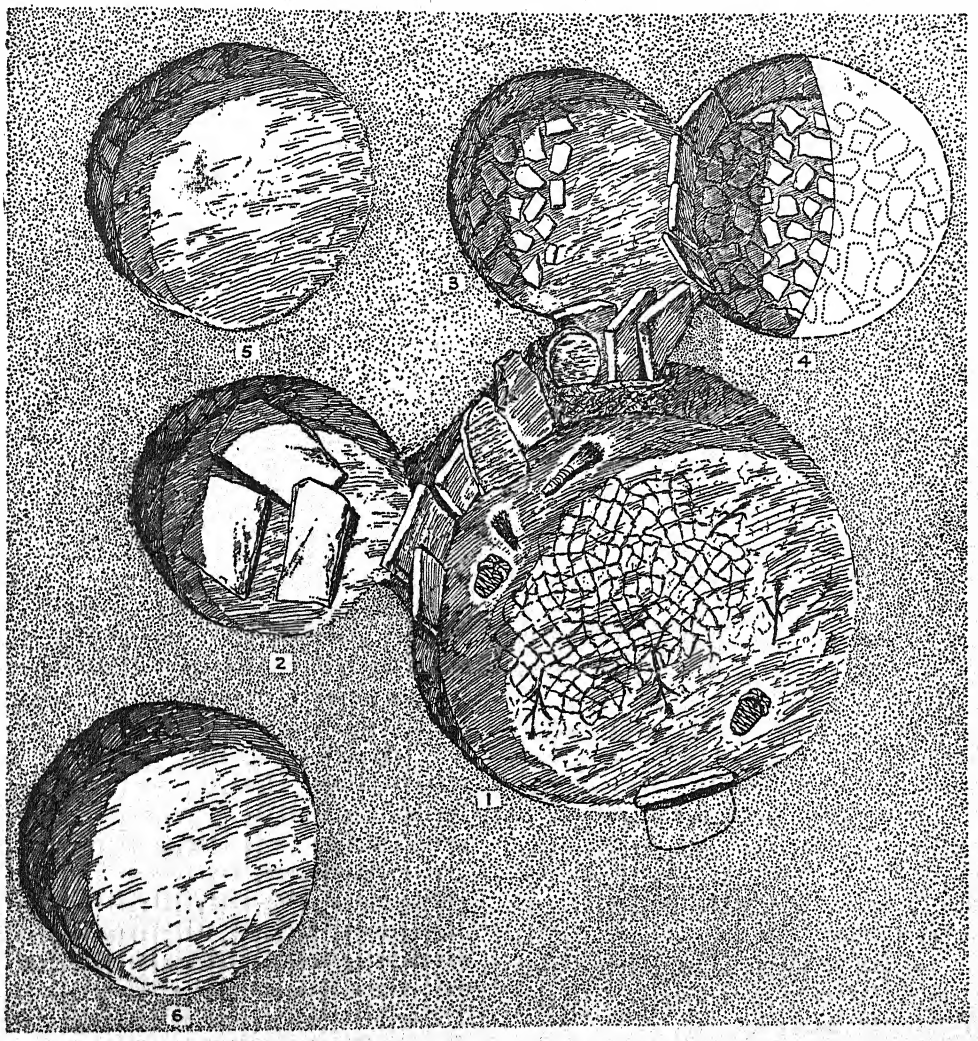


FIG. 4. Cists in Steamboat Cave, Steamboat Canyon, Grant Co., N. M.

On the level space at the front of South Bay, below an accumulation of Pueblo trash, rocks, and a layer of grass bedding, were 6 circular cists cut into the hard clay and rock fill (figs. 3, 4).

Cist 1. Four feet 5 inches in diameter; cut 2 feet 4 inches into the fill; bottom, 3 feet 6 inches below present surface. On the bottom was a thick bed of bunch grass in which were some small corn-

stalks and leaves; below the bed, a coarse mesh yucca-fiber carrying net; at either side of the bed, a worn yucca Type 10 scuffer toe sandal; at south side, a bundle of herbs (*Artemesia*) and a cedar-bark torch. Standing on edge at the north side of the pit was a flat rock in front of a pocket cut into the pit wall. This may have served for storing small articles, but nothing was discovered in it. On the edge along the south side were found 3 stone slabs which seemed to serve no purpose and may have slid into the pit as it filled with rubbish. No small timbers were found in the pit to indicate that it had ever been roofed. From the contents it appears to have been a cist used for sleeping and as a protection from cold winds sweeping through the cave.

Cist 2. Two feet in diameter; cut 2 feet into fill; an adjunct to Cist 1 on the northeast. It was separated from Cist 1 by 2 stone slabs, set on edge, which reached to the surface. Three slabs were found lying in it in such a way as to suggest its having been roofed. The pit was lined with soft bunch grass.

Cist 3. Two feet 7 inches in diameter; 1 foot 8 inches into fill; adjoined Cist 1 on the southeast; floor 8 inches higher than that of Cist 1 and separated from it by small stones set on edge, one of which was a disc 8 inches in diameter and 1 inch thick, having 1 side rubbed smooth. The east third of the floor was paved with small flat stones. Some shelled corn which escaped the rats was found on the floor below the rubbish.

Cist 4. Two feet 10 inches in diameter; 2 feet 7 inches deep. This has been dug at a later time than Cist 3 and cut into it on the southeast. The west third of the cist was a pocket roofed by the hard cave fill. Slabs were set on edge along the east side adjoining Cist 3, and the floor was paved with thin spalls. In the fill were a few corncobs and some charcoal.

Cist 5. Two feet 10 inches in diameter; 1 foot 3 inches deep; 1 foot east of Cist 1. The cist was filled with rubbish.

Cist 6. Three feet in diameter; cut 1 foot 6 inches into fill; 2 feet north of Cist 1. This cist was also filled with rubbish. No specimens were found in the fill of Cists 5 and 6.

At the back center of South Bay, east of this cluster, was a small cist curbed with stone slabs set on edge. It was lined with grass and contained 27 extra-large corncobs, four of which had a stick thrust into the large end of the cob. Rodents had eaten the grain of this selected seed corn. All of the cists but one were too small for sleeping purposes and had been used for storage. The failure of earlier explorers to discover this series of pits is probably explained by the layers of slabs from the cave roof which had fallen upon and concealed it. Since no part of the encrusted and stained ceiling showed scars to indicate a recent fall, and also because there was an undisturbed mat of grass bedding and refuse underneath the slabs already down, it is safe to infer that the cists below were of early origin.

The sloping hard floor of Main Cave gave no signs of occupation other than the breastworks, and no artifacts were found around or through the heaped rock falls. The front of Bat Cave may have been utilized, but the fill here had been torn up by the guano-diggers and all signs destroyed. A reed arrow and a cached ceremonial bow, with some grass-stem and wooden pahos, were found under and at the back of the large rock fall. South Bay of the Main Cave had been the principal camping place; it produced most of the specimens of both early and late periods. Great quantities of corncobs indicate a long occupation. Later it was discovered that the layer of grass above the cists extended farther back into the cave. Secreted in this refuse, below fallen rock and behind a heavy outward-tilting fall at the extreme south corner, were many painted fragments of *tablitas*, and several bundles of very small ceremonial bows with miniature grass-stem and stub pahos attached.

In the accumulation of bedding and trash toward the front of the cave was a mixture of both Pueblo and Basket-maker artifacts, the latter represented by such objects as dart foreshafts, spur ends of darts, a yucca container, a native walnut tubular pipe, and pieces of dry-dyed coiled netting on warp fabric. The container was below the slabs and well embedded in a disturbance of the natural water-deposited clay and rock fill. The coiled netting on warp fragments was found close to Cist 1, 1 1/2 feet below the surface in the same type of fill, which reached a depth of 2 1/2 feet. The proximity of the Basket-maker articles, some of them quite deep in the refuse around the clustered cists, indicates that the pits were dug by these people.

Artifacts, Pueblo

large corncobs, some with sticks thrust into stem end; beans

7 fragments of large bows; reed arrows; arrow foreshafts; arrow bunt; light, round throwing stick

cotton cordage, some dyed black or red

sandals of the following types: 9 Type 10, 9 Type 11

basketry fragments, two-rod-and-bundle triangular foundation, fine stitch, wood-splint sewing element

oblique twilled yucca-leaf matting, over-3-under-3

crescent pahos (a reed cigarette attached to a bundle of such crescents); reed whistle; grass-stem pahos; painted twig pahos; 80 painted and 2 unpeeled stub pahos; complete crook-staff paho and head of another; 4 roundel-staff pahos; painted sticks; 3 arrow pahos; 16 perfect miniature ceremonial bows and 196 fragments; 5 sets of miniature ceremonial bows with grass-stem and stub pahos

sherds of the following types: plain brown; red-wash; Mimbres stick-marked; Mimbres Sharp Corrugated;[4] Mimbres Rubbed Corrugated; Mimbres Classic Black-on-white; Mimbres Bold-face Black-on-white

bone weaving tool; painted bone splinter

small, discoidal, turquoise beads; small, discoidal, white stone beads; small, discoidal, black stone beads; tubular bone and an *Olivella* shell bead on cotton string

cylindrical blocks; sections of peeled and painted twigs 1 to 1 1/2 inches long, suggesting gaming pieces; small twig hoops

Artifacts, either Pueblo or Basket-maker

cornhusks and stalks; squash rinds; gourd rinds; herbs

fiber cordage, some dyed red or black; coarse shredded yucca-leaf carrying net (full-turn coiled netting) bundles of grass

49 reed cigarettes; unpeeled twig pahos; split-stick wands; fragments of wooden *tablitas*

buckskin

stone scraper with retouched edge; rubbing stone, discolored with red and yellow oxide; red oxide

twigs with shavings attached, illustrating sectioning; fire hearths and drills; cedar-bark torch; planting stick

bone awls; bone flaking tool

gaming hoops or rings

Artifacts, Basket-maker

kernels of Tropical Flint corn; small corncobs

spur end of dart; pointed dart foreshafts; stone-tipped dart foreshafts; dart bunts

fur cloth; dry-dyed coiled netting on warps (fiber cordage)

basketry fragment, bundle-with-rod-core foundation, coarse stitch, wood-splint sewing element

yucca-leaf container

flexible bear-grass cradle

leather pouch

tubular wooden pipe

wooden pins; hair ornaments

[4] This ware has straight, clear-cut coils; see Cosgrove 1932, pl. 93, *a*.

Shelter Cave (S. E. 1/4 Sec. 34, Town. 15 S., R. 15 W., Grant Co., N. M.). Half a mile directly south of Steamboat Cave, below an overhanging cliff with southern exposure, was a camp site that had been used for many years by hunting parties.

Several pictographs of zigzag lines and the typical lizard (see p. 155) were painted on the back wall of the shelter. This is a Pueblo site with no indications of Basket-maker occupancy.

Artifacts, Pueblo

sherds of the following types: plain brown- or red-paste (olla forms); Mimbres Sharp Corrugated; Mimbres Classic Black-on-white (bowls); Tularosa Black-on-white (bowls)

great amount of flint chips; stone cores; oval-depression metates (Type 2);[5] turtle-back manos; oval rubbing stones; disc-shaped rubbing stones

On the way up the Gila River above Cliff, New Mexico, to the mouth of Sapillo Creek, and up the latter stream, the following sites were located.

Site 1, Mogollon Creek Cave (Sec. 4, Town. 13 S., R. 17 W., Catron Co., N. M.). One-half a mile above the mouth of Lookout Canyon, in Mogollon Creek Canyon, a northern tributary of the Gila, is a shallow cave in the north wall 125 feet above the stream (fig. 5). At one time the cave was much larger, but part of the floor had broken off and had slid into the canyon, leaving only a small section 8 by 10 feet, where refuse 1 to 1 1/2 feet deep still remained.

The cave was used for a shrine and possibly at times as a refuge to avoid the danger of camping in the very narrow canyon.

A wooden pin which later investigation may prove to be of Basket-maker manufacture was the only possible evidence of that culture.

Artifacts, Pueblo

broken reed arrows

cotton string

grass-stem pahos; 2 painted stub pahos; miniature ceremonial bows

sherds of the following types: plain polished red-slip red-paste; Mimbres Classic Black-on-white

Site 2, Cliff Ruin, Gila River (Sec. 24, Town. 14 S., R. 16 W., Grant Co., N. M.). Farther up the Gila, near the mouth of Shelley Canyon, is a

[5] Cosgrove, 1932, pl. 32, *b*.

1-room cliff-dwelling on the north side of the Canyon (fig. 5). No artifacts were recovered.

Site 2a, Cave in Cave Canyon (Sec. 26, Town. 14 S., R. 16 W., Grant Co., N. M.). This is situated approximately 2 miles up Cave Canyon, a southern feeder to the Gila, entering that

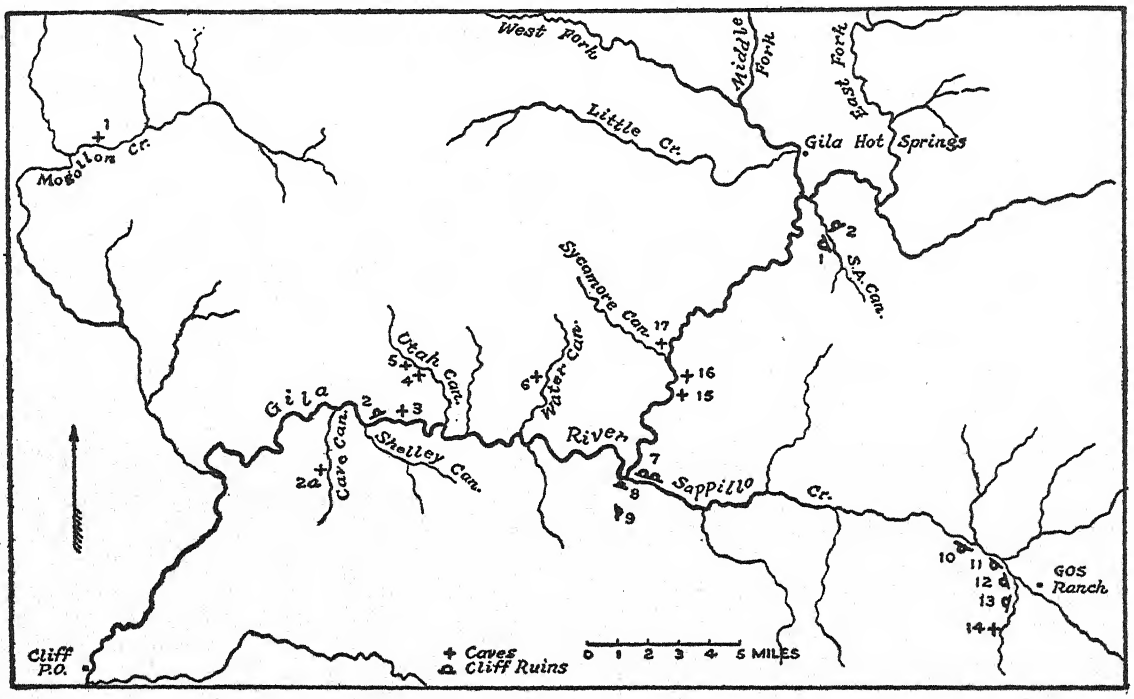


FIG. 5. Mogollon-Sapillo Creek section of the Gila River, including that portion as far up as the mouth of the East Fork.

stream west of the mouth of Shelley Canyon (fig. 5). This site was not visited by us but was described as 2 openings in the cliff, one above the other. Regarding 2 decorated coiled baskets (fig. 98) taken from the cave sometime before 1905 or 1906, and purchased for the Peabody Museum, their finder wrote, "The cave was a kind of a two-story one, and the baskets were found in the upper story. There was an average of 6 to 12 inches of loose dirt on the bottom of the cave. The baskets apparently had been covered up in one corner and the dirt had been partly raked off by animals of some kind, so that one of them was partly exposed. In getting it out, found the other under it."

The informant did not give dimensions of the caves or other data as to evidence of occupation. All that can be said is that they belong to the Pueblo period. On inspecting the baskets, Dr. Kidder said that had they been found in northern Arizona, he would not hesitate to place them as Pueblo I.

The baskets are two-rod-and-bundle triangular foundation, wood-splint sewing element.

Site 3, Cave, Gila River (fig. 5). In the same section, 1 mile above and east of the mouth of Shelley Canyon, on the north side of the Gila River, were some rock shelters beneath the overhang of a sandstone rim, 600 feet above the stream. At the west end of one overhang loose rocks were piled for a windbreak, enclosing a space 6 by 10 feet. On the back wall were faded red pictographs, one or two in the form of a human being or lizard. A few Pueblo specimens were found in a small amount of refuse thrown out from the shelter. There were no artifacts which could be definitely identified as only Basket-maker.

The only practical use for the place was as a camp for hunting parties on their way out of the deep canyon to timbered and grass-covered parks above.

Artifacts, Pueblo

small corncobs; fiber quids
arrow foreshaft

2 Type 11 sandals
sherds of the following types: plain red (olla); Mimbres Sharp Corrugated (olla)

Artifacts, either Pueblo or Basket-maker

fiber cordage; wisp of yucca fiber; coarse shredded yucca-leaf carrying net (coiled netting)
rod container of willow twigs fastened together with twined yucca-fiber cord
split-stick wands; fragments of wooden *tablitas*, decorated with burned lines or painted solid color
2 rubbing stones (1 discolored with red oxide)
cedar-bark torch
fragments of gourds

taken out numbers of small pottery vessels and arrows. The place had not been lived in. The material it contained and its almost inaccessible location in a gloomy, rough canyon strongly indicate that both Pueblo and Basket-makers used it as a shrine on their way up the canyon from the Gila River. By digging in a small amount of refuse we recovered a few specimens.

Artifacts, Pueblo

4 complete reed arrows; 7 broken reed arrows
cotton cordage
1 Type 11 sandal

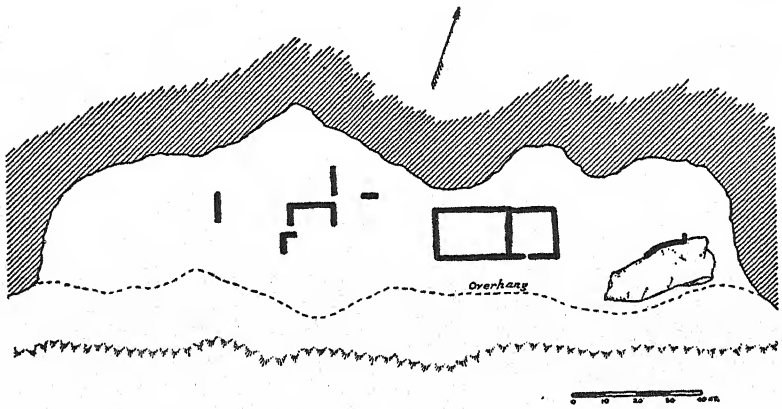


FIG. 6. Plan of Site 7, Sapillo Cliff Ruin.

Sites 4 and 5, Caves in Utah Canyon Sec. 17, Town. 14 S., R. 15 W., Grant Co., N. M.). These 2 caves were among several others 1 1/2 miles above the boxed mouth of this canyon which enters the Gila River from the north (fig. 5).

The caves were temporary Pueblo sites, showing no evidence of earlier visitors.

Artifacts, Pueblo

2 small corncobs
arrow foreshaft
sherds of the following types: plain brown-paste; Mimbres Corrugated
notched stick

Site 6, Cave in Water Canyon Sec. 12, Town. 14 S., R. 15 W., Grant Co., N. M.). The cave is on the west side of Granny Mountain, in a low cliff on the west wall of the canyon which leads south into the Gila River (fig. 5). The cave is 24 feet deep by 35 feet long and is accessible only by climbing 18 feet up a tree standing in front of it.

Three years before our visit cowboys had

basketry fragment, one-rod foundation, multiple-stitch-and-wrap, interlocked, wood-splint sewing element (sifter basket); fragments of two-rod-and-bundle triangular foundation basketry, wood-splint sewing element
macaw feathers; macaw feather ornament, base of quill wrapped and attached to cotton cord

Artifacts, either Pueblo or Basket-maker

squash rind
fiber cordage; knots of yucca fiber
3 reed cigarettes; fragments of wooden *tablitas*
buckskin

Artifacts, Basket-maker

two-rod-and-bundle triangular foundation basketry, wood-splint sewing element

Site 7, Cliff Ruin in Sapillo Creek Canyon (Sec. 23, Town. 14 S., R. 14 W., Grant Co., N. M.). This ruin is located in Sapillo Creek Canyon, 300 yards above the point where it enters the Gila River from the east (figs. 5; 53, *a*); southern exposure. The length of overhang of the cliff is 240 feet; depth to line of overhang, 30 to 60 feet. A few walls standing 2 to 3 feet high and outlines of lower courses at 3 places indicated

the former presence of 7 rooms (fig. 6), some of good size. The remains of one showed a length of 15 feet, and 2 abutting rooms were 14 by 22 feet and 14 by 15 feet, inside measurements. At floor level in the south wall of the latter room was a small opening 12 inches square, possibly a ventilator. The south wall of a room at the east end of the cave was curved to conform with the outer edge of a large boulder upon which it was built. More rooms were probably built in this large shelter, but it had been badly disturbed by digging and the walls broken down and obliterated by the tramping of cattle. Excavations below

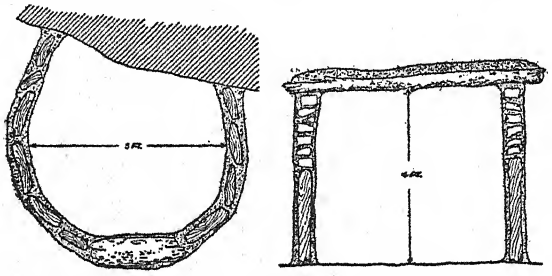


FIG. 7. Granary in Cliff Ruin 13, Sapillo Creek. Plan and section with dimensions; walls of wooden slabs set in adobe with upper course laid with flat stones and adobe; heavy coating of adobe over roof poles; wooden slab for door sill.

the floor of 1 room uncovered a disturbed infant burial and scattered adult bones. Surface and some refuse specimens indicated a Pueblo site; no Basket-maker remains.

Artifacts, Pueblo

corncobs; squash rind
arrow foreshafts
cotton cordage; plain-weave cotton cloth
painted sticks; painted twig paho; 9 stub pahos; miniature ceremonial bows
sherds of the following types: plain red-brown-paste; red-slip, red-paste; Mimbres Sharp Corrugated; Mimbres Rubbed Corrugated; Mimbres Waved Indented Corrugated; Mimbres Rubbed Incised Corrugated; Mimbres Classic Black-on-white; Mimbres Classic Polychrome; Mimbres Bold-face Black-on-white; Tularosa Polished Black interior; Tularosa Corrugated; Tularosa Black-on-white jug handle;[6] Zuñi, white slip, black glaze, red matte decoration
sectioned stick; twigs tied in a bundle
squash container
bone awl; bone flaking tool
fragment of *Glycimeris* shell bracelet

[6] Cosgrove, 1932, corrugated wares, p. 93.

Sites 8 and 9, Cliff Ruins, Gila River (fig. 5). In the vicinity of the foregoing cliff ruin at the mouth of Sapillo Creek were numbers of shallow caves. In two of these were the remains of small circular-walled granaries, one containing plain brown sherds. All were Pueblo sites.

Sites 10, 11, 12, and 13, Sapillo Creek Cliff Ruins (Sec. 16, Town. 15 S., R. 12 W., Grant Co., N. M.). Farther east and up the Sapillo, near the G O S Ranch, are 4 semicircular-walled cliff-ruin granaries (fig. 5). That in Site 13 was in sufficiently good preservation to show its construction (figs. 7; 53, *b*). Nothing remained in these Pueblo period granaries.

Site 14, Cave, Gila River. One of the several shelters in the same vicinity contained numbers of bright pictographs colored red, yellow, vivid blue, and green. The pictures are judged to be Puebloan (fig. 47, *c*).

Sites 15 and 16, Caves, Gila River (fig. 5) Returning to the mouth of Sapillo Creek and proceeding up the Gila toward Gila Hot Springs, we investigated 2 caves with northern exposure that had never been occupied.

Site 17, Cave, Gila River (fig. 5). Above the mouth of Sycamore Canyon, which enters the Gila from the west, is a small cave with southern exposure. In a layer of soft grass bedding below fallen stones were found Mimbres Classic Black-on-white, Mimbres Smoothed and Waved Corrugated sherds, also a mano and a Type 2 oval-depression metate.[7] The size and contents of the shelter indicate a Pueblo camp site.

S A Canyon, Cliff Ruins 1 and 2 (Sec. 21, Town, 13 S., R. 13 W., Grant Co., N. M.). The intermittent flow in the short S A Canyon is to the north and enters the Gila near the mouth of the East Fork of that stream (fig. 5).

S A Canyon, Cliff Ruin 1 (fig. 54, *a*). This cliff ruin is on the west side of the canyon about 3 miles above its mouth. It is a 1 room house, facing east under an overhang in a cliff, 150 feet above the bottom of the canyon. The rubble walls, laid with hard cement-like adobe, locally known as caliche, were in good condition. In the east there was a window with wood lintel, and in the south, a door with wood lintel and adobe sill. A timber was laid lengthwise in the top of the east wall at its junction with the roof of the overhang. In the southeast corner of the room was a semicircular storage bin with walls of stone slabs

[7] Cosgrove, 1932, pl. 32.

set on edge in adobe, and with a cone-shaped roof of sticks, overlaid with spalls and adobe (fig. 8). The rock bottom of the room was leveled to some extent with rubbish but there was no evidence of a plastered floor The room was large enough to shelter 3 or 4 people.

All articles found in clearing the room were of Pueblo origin.

Artifacts, Pueblo

large red and white corncobs; knotted husks pulled from the ear, bound with strips of yucca leaves so corn could be suspended or carried

coarse shredded yucca-leaf carrying net (full-turned coiled netting)

sherds of the following types: plain brown-paste; Mimbres Rubbed Corrugated; Mimbres Waved Indented Corrugated; Mimbres Classic Black-on-white

hammerstone; small oval mano

large quill

cedar-bark torch

S A Canyon, Cliff Ruin 2 (fig. 54, *b*). This is a small cave in the north wall of a short canyon coming into S A Canyon on the east, 1/4 of a mile below, and in sight of Cliff Ruin 1. The cave is at the top of the talus, considerably over 100 feet above the canyon bottom. It is 20 feet deep and 21 feet wide along the overhang. The level rock floor, 12 feet above the talus, occupies the rear two-thirds of the cave. The back of the cave is partitioned off with a perfectly preserved outward-curving wall of spalls and caliche masonry enclosing a space 6 by 9 feet. In the center was a small door 1 foot 9 inches wide and 1 foot 11 inches high, with a lintel of 3 pieces of split wood. The room was large enough for sleeping quarters and might also have served as a granary, since outside were found large chunks of adobe and stone which had been used to seal the door, apparently to keep rodents from the supplies.

There was no refuse in the room, but a small deposit was found outside on the rock floor. Specimens were all Pueblo, with no signs of Basket-maker.

Artifacts, Pueblo

large red and white corncobs; cornhusks tied in knots loops of yucca leaves

fragments of unfired coiled pottery; blackened plain red-brown-paste sherds

flint chips; flattened rubbing stone; chunk of rubbed hematite

MIDDLE FORK OF THE GILA RIVER

As we continue up the Gila and then up its West Fork for a distance of 12 to 15 miles above Gila Hot Springs (fig. 57, *a*), the valley widens in places and furnishes sufficient arable land to have supported a considerable population. This cultivable area is marked by numbers of small and large village ruins, and the only pretentious cliff dwelling in this part of New Mexico, now a National Monument.

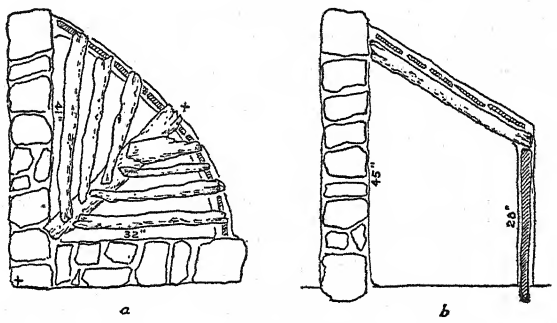


FIG. 8. Corner storage bin in S A Canyon, Cliff Ruin 1, *a*, plan and the way the roof sticks rested on sloping ridge pole and adobe-coated stone wall slabs; *b*, section through *x–x*; dimensions indicated.

Next we come to cliff ruins and caves on the Middle Fork of the Gila (fig. 9). These lie along the line between Town. 12 S., R. 13 W., Town. 12 S., R. 14 W., Catron Co., N. M. This branch of the Gila, flowing for the greatest part of its length through a precipitous canyon from the northwest, approximately parallels the West Fork and joins it below the Gila Cliff Dwellings National Monument.

Included in the numbered caves and cliff ruins in the lower 6 miles of the Middle Fork is Cliff Ruin 17, opposite the mouth of Little Creek on the Gila itself. Several ruins and caves were located as accurately as possible from a temporary camp established on the Middle Fork, 3 miles above its junction with the West Fork.

Cliff Ruin 17, Middle Fork, Gila. This is a small granary in the north wall of the Gila Canyon, opposite the mouth of Little Creek. It is 75 feet above the river, in a horizontal crevice 2 feet high, which is walled to form a storeroom 6 feet deep by 10 feet long. Entrance is through a door in the wall 20 inches wide. Nothing was in the storeroom, but under a small overhang east of it a few specimens were taken from a pack rat's nest. No Basket-maker remains were found.

Artifacts, Pueblo

corncobs
sherds of the following types: rough black; red-wash-paste, plain; Mimbres Classic Black-on-white
rubbing stone
pointed stick
piece of sewed gourd rind
base of large antler

A trapper and some cowboys reported cave shelters containing small ruins, probably granaries, under an overhang in the low north wall of the canyon and extend for a distance of 124 feet along the top of the talus (fig. 10). In some cases the walls reached the top of the shelter, while in others some kind of roof must have been necessary. The masonary was composed of irregular small and large rocks laid in hard caliche mortar, which was applied also to the inner surface as a plaster.

Cliff Ruins 1, 2, 3, and 9, with straight walls, seemed to have been dwelling places. Ruin 6, a

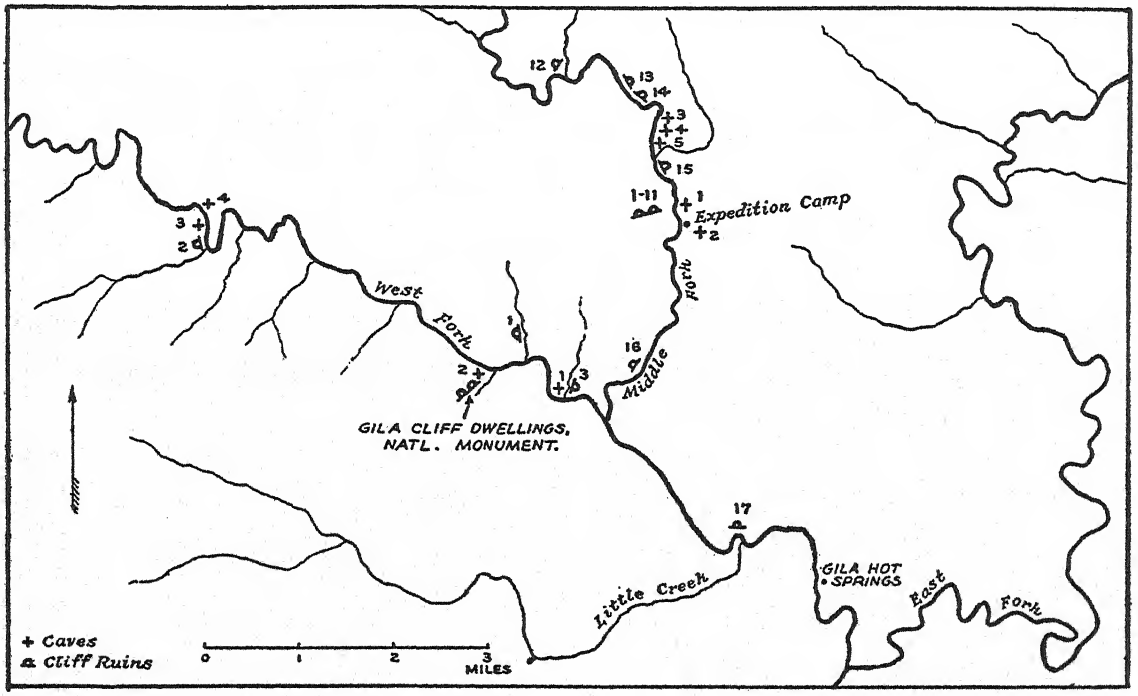


FIG. 9. Caves and cliff ruins on Middle Fork and West Fork of the Gila River, Catron Co., N. M.

farther up Little Creek and in other canyons tributary to the Gila.

Cliff Ruin 16, Middle Fork, Gila (fig. 9). Situated 1 mile above the mouth of the Middle Fork, on the west side of the canyon and opposite a hot spring beside the stream, is a cave high in the rimrock, with a small walled granary in the north end.

Cliff Ruins 1–11, Middle Fork, Gila (fig. 10). The ruins consist of a series of 11 houses and granaries situated across the river and a short distance upstream from the expedition camp. The group of buildings is completely concealed by trees and brush in a short canyon coming from the west into the Middle Fork. The houses are granary, was located at the east end of the overhang. This must also have been utilized as a dwelling, since there was an adobe-lined firepit 18 inches in diameter and 5 inches deep in the floor. A wide overhang in front of Cliff Ruins 7, 8, and 9 furnished shelter from storms and undoubtedly was occupied. Characterized by curved walls, similar to like structures in the district, the rest of the rooms in this group are termed granaries; however, some of them were large enough for sleeping quarters.

CLIFF RUIN 1 (fig. 55, *a*). This small house was 4 feet 7 inches by 4 feet 8 inches with a window 1 foot square in the south wall, which stood 4 feet 5 inches high. The west wall had

almost disappeared, and if there had been an entrance it was probably through this side. An extension of the east wall 5 feet 5 inches high formed the west wall of Ruin 2.

CLIFF RUIN 2 (fig. 55, *a*). This room was 9 1/2 feet deep by 11 feet 8 inches long. The south wall had almost disappeared; the east wall was a party wall between it and Ruin 3, and joined the cave roof at heights of 5 to 7 feet. Heavy coats of plaster still adhered to the inner west wall, on which a grotesque animal was painted in black (figs. 47, *b*; 56, *b*). The level floors of Ruins 1 and 2 had been broken by the tramping of cattle. The height of the rock shelter above Ruin 1 and the adjoining part of Ruin 2 would seem to have required roofs, which have now disappeared.

CLIFF RUIN 3 (fig. 56, *a*). A room approximately 6 feet square adjoins Ruin 2 on the east and lies behind a large boulder. In the front wall was a door 18 inches wide, with lintel missing. Extending along the inside, 16 inches below the door sill, was a bench 10 inches wide. All walls of this room reached the cave roof. Through the west wall near its south end, and 2 feet below the ceiling, ran a ventilator 10 inches in diameter. No floor remained.

One burial was found (see p. 161).

CLIFF RUIN 4 (fig. 56, *a*). A granary formed by a rounding front wall was built to the cave ceiling and set against the east wall of Room 3 and the back wall of the cave. The angular space enclosed was 5 1/2 by 6 feet. In the wall was a door 14 inches wide by 18 inches high, with the stone lintel in place. This large granary clearly belonged to the occupants of Ruins 1 to 3, and its floor, like those of the ruins, had been destroyed.

CLIFF RUIN 5. This granary had broken, curving walls abutting the back of the cave. The west side stood 3 feet 8 inches high. To the east of a door 18 inches wide, indicated by a sill in place, the wall could be traced only by the lower courses of stones. The height of the doorway could not be determined. Apparently the walls had reached to the cave ceiling.

CLIFF RUIN 6. This was a U-shaped granary 5 by 6 feet, with the lower courses of curving walls abutting the back of the cave. There were no indications of the original height of the walls nor of the size of the entrance. This storehouse was in the same bay of the cave which contained a firepit.

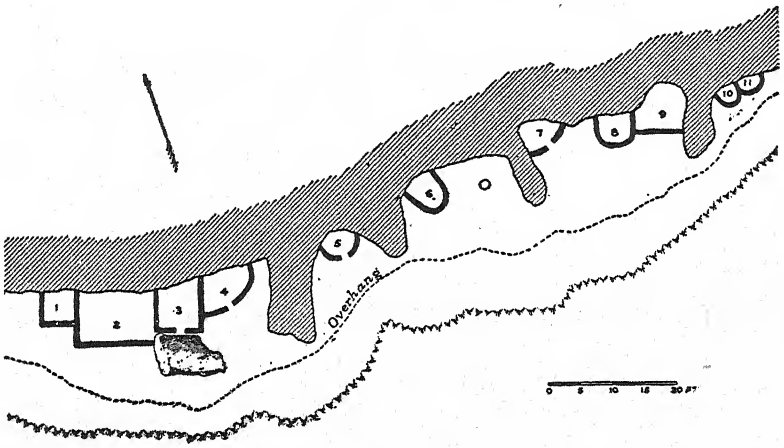


FIG. 10. Plan of Cliff Ruins 1–11, Middle Fork, Gila River, Catron Co., N. M.

CLIFF RUIN 7 (fig. 55, *b*). A curved wall 8 feet long across 1 corner of the cave formed a granary 5 feet wide. This was the best preserved granary in the series, with a well-laid wall 7 1/2 feet high, extending to the cave roof. A door 22 inches wide by 24 inches high, with wooden lintel in place, was located in the center of the wall.

CLIFF RUIN 8. A semicircular granary 4 1/2 by 5 1/4 feet was indicated by a lower course of wall abutting the back of the cave.

CLIFF RUIN 9. Remains of a straight wall 7 feet 10 inches long extended from the east side of Ruin 8 to the cliff. This wall formed the front of Ruin 9, which measured 6 1/2 feet from north to south. No indications were left of the door entering this room.

CLIFF RUINS 10 AND 11. These granaries, with

only the lower course of walls in place, adjoined semicircular enclosures 3 by 3 feet and 2 1/2 by 3 1/2 feet, respectively, and were located at the eastern end of the line of ruins.

This series of Pueblo shelters yielded nothing to suggest earlier occupancy.

Artifacts, Pueblo

Sherds of the following types: rough, plain brown-paste; Mimbres Classic and Bold-face Black-on-white; Mimbres Sharp and Rubbed Corrugated; Tularosa fillet rim sherds

Below camp on the east side of the canyon, 100 feet above the stream, were a number of pictographs: broad zigzag lines in red, straight wide bars outlined with yellow, a sun symbol (?) in red composed of a circle with angular points around the circumference, concentric circles in red, marks of small hands dipped in red paint, small hands stenciled in red, and the typical lizard. Numbers of other pictographs were too faded to be traced.

Cave 2, Middle Fork, Gila (fig. 9). The cave was situated between the pictograph cliffs and camp, in the north wall of a side canyon coming into the Middle Fork from the east.

Artifacts, Pueblo

squash rind
nock end of reed arrow
knots of shredded yucca
part of a Type 14, 10-warp sandal
fragments of wooden *tablitas*
sherds of the following types: plain brown- to black-paste; Mimbres plain brown-paste, stick-marked; Mimbres Rubbed Corrugated (olla); Mimbres Classic Black-on-white
2 small flake scrapers

Cave 1, Middle Fork, Gila (figs. 9; 57, *b*). North of camp and opposite Cliff Ruins 1–11 is a large shallow cave, or overhang, 55 feet long, situated high in the east wall of the canyon. The cave faces west and is reached by a hard climb of 200 feet from the river. Among the fallen boulders and loose rocks lying on the sloping floor was a small accumulation of grass bedding and trash, in which were Pueblo and Basket-maker artifacts.

Artifacts, Pueblo

bean
arrow foreshafts; arrow points
bundle of cedar twigs rolled in a yucca net and tied with strands of feather cloth
Type 11 sandal
pot-rests of coiled twigs with leaves attached
2 miniature ceremonial bows
Upper Gila Black-on-white sherd
obsidian nodules
cylindrical gaming sticks or counters

Artifacts, either Pueblo or Basket-maker

diminutive corncobs; squash seeds; squash rinds; gourd rind
fiber cordage; yucca strap
coarse shredded yucca-leaf carrying net (full-turned coiled netting)
5 reed cigarettes; looped twig pahos; unpeeled twig pahos
iron oxide; quartz crystals
wooden awl; wooden crochet hook (?); fire drills, fire hearths
blackened tubular bone; painted bone splinter
thorn pin

Artifacts, Basket-maker

2 spur ends of darts
dart foreshaft

Cliff Ruin 15, Middle Fork, Gila (fig. 9). There were remains of a small semicircular granary 1/2 a mile above camp, on the east side of the canyon. Nothing was found here.

Caves 3, 4, and 5, Middle Fork, Gila (fig. 9) These are on the east side of the canyon in the second mile above camp; none more than 15 feet above the river. Caves 3 and 5 are small and appeared never to have been occupied. Cave 4 is quite a large shelter. All face west and are too shaded and cold to have been used for more than temporary camp sites. In Cave 5 a plain sherd and a fire drill indicated a Pueblo camp.

Cliff Ruin 14, Middle Fork, Gila (fig. 9). One-eighth of a mile below Cliff Ruin 13, also in the east canyon wall, is a shallow cave with the remains of a small circular-walled granary and a camp site in front.

Artifacts, Pueblo

Sherds of the following types: Mimbres Rubbed Corrugated; Mimbres Classic Black-on-white; Tularosa Corrugated

Cliff Ruin 13, Middle Fork, Gila (fig. 9). A short distance downstream below Ruin 12, this ruin was built in a small cave in the east wall of the canyon. At the north end were remains of a

small enclosure, probably a granary. The only objects found were 2 round sticks of equal length, which may have been throwing sticks or the lintels of a small broken-down doorway.

Cliff Ruin 12, Middle Fork, Gila (fig. 9). This site lies 2 1/2 miles up the Middle Fork above camp, at the mouth of a side canyon from the east, and has a southern exposure. It proved to be a fortified refuge cave high in the cliff, with a 4-foot defense wall across the front.

Artifacts, Pueblo

some small corncobs
fiber strings; knots of yucca leaves

This section of the Middle Fork, as well as the upper reaches of the canyon, is really a gorge, too narrow and rocky for agriculture. From the character of the cliff ruins and the contents of caves along the canyon, it seems that the shelters were not year-round homes, but were used only in the winter as temporary quarters and for storabe of grain, after the harvest had been gathered in the wider valley of the Gila, at the mouth of this branch. An abundance of wild turkeys, deer, and antelope still to be found in the surrounding woodland parks indicates that the ancient peoples enjoyed a bountiful meat supply.

WEST FORK OF THE GILA RIVER

In the lower 6 to 7 miles of the West Fork of the Gila River which angles through Town. 12 S., R. 14 W., Catron Co., N. M., are 3 small cliff ruins and 4 caves, one of which adjoins the large caves sheltering the buildings of the Gila Cliff Dwellings National Monument. This is Cave 2, described below.

Cliff Ruin 3, West Fork, Gila (fig. 9). This site is 1 1/2 miles below the National Monument, on the north side of the West Fork. Remains of foundation walls of 2 small rooms still exist in a shelter below a low rock ledge at the east side of the mouth of a tributary draw. Nothing was found there, since flood water had washed into the room.

Cave 1, West Fork, Gila (fig. 9). This is a small low cave west of and opposite Ruin 3. In it was a small circular shrine of piled rocks. From the cave and surface finds at a camp site in front of it, Pueblo sherds of the following types were gathered: Mimbres Sharp Corrugated, Mimbres Classic Black-on-white, Mimbres Bold-face Black-on-white, Three Rivers Red-on-terracotta, Tularosa plain red-paste (polished black interior).

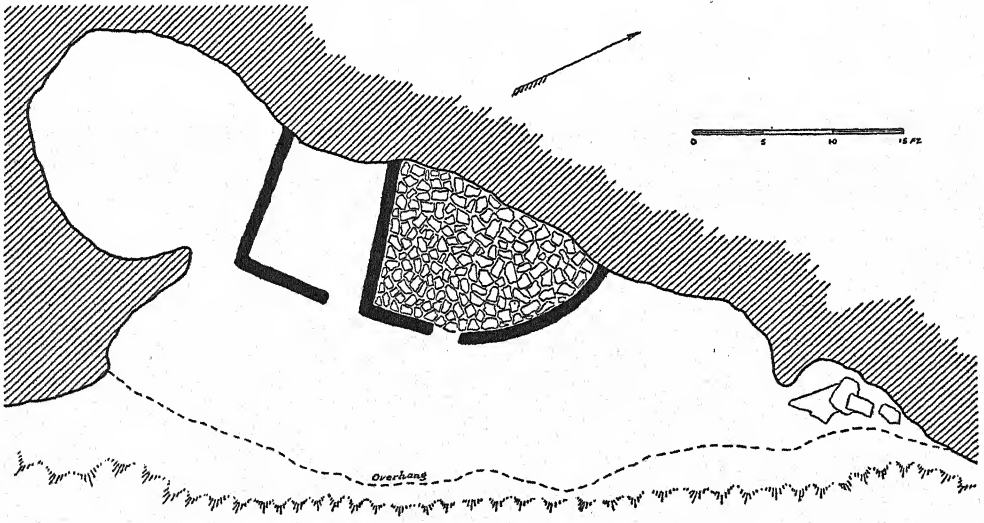


FIG. 11. Plan of Cliff Ruin 1, West Fork, Gila River, Catron Co., N. M.

Cliff Ruin 1, West Fork, Gila (figs. 9 and 11). A small 2-room house was built in a cave 300 yards up a canyon which enters the West Fork from the north, 1/4 of a mile below the National Monument. Exposure is to the southeast, with the front wall of the rooms 12 feet back of a low overhang 64 feet long. Walls of large and small flat stones, well laid in hard caliche mortar, abutted the back wall of the cave and extended to the roof at heights of 4 to 6 feet. The rectangular southern

room measures 6 1/2 to 7 1/2 feet wide by 10 to 11 feet deep. There was a broken doorway in the front, next to the partition wall between the southern and northern rooms; a doorway, approximately 30 inches wide by 33 inches high; lintel and sill are missing. There were no signs of floor in this room, as it had been dug over. The curving front wall of the northern room gives it the form of a quarter circle, measuring 16 feet long by 10 feet wide; door opening, 24 inches wide by 36 inches high; lintel is missing; the floor is paved with large stone slabs as the illustration shows.

Artifacts, Pueblo

sherds of the following types: plain red-brown-paste (olla); Mimbres Smoothed Corrugated; Mimbres Waved Corrugated; Mimbres Classic Black-on-white; polished red-slip (bowls)

Type 2 oval-depression metate; mano for Type 2 metate; arrow straightener

Cave 2, West Fork, Gila (fig. 9). A large cave 70 to 80 feet deep, adjoins on the north the group containing the cliff houses of the Gila National Monument. The entrance is very high at the front and, as the cave is very dark and has a trough-like floor sloping at an angle of at least 45 degrees, it would not have been suitable for the erection of houses. From appearances it seems that originally the cave was high in the sandstone cliff and afterward was undermined, so that nearly all of the floor fell and only a sloping shelf along the back wall remained. A few boulders rested on this shelf, behind and under which were rat nests and some refuse. Behind one of the boulders was the disturbed skeleton of an adult (see p. 161). In the trash around the bones were 2 bone awls, fragments of decayed two-rod-and-bundle basketry, and pieces of feather cloth. Fragments of darts from other places in the cave denote the former presence of Basket-makers in what afterward became a Pueblo site.

Artifacts, Pueblo

broken reed arrows; arrow foreshafts

feather cloth

fragments of 5 Type 14 (4 and 6 warps) sandals

basketry fragments of two-rod-and-bundle triangular foundation, wood-splint sewing element

miniature ceremonial bow

sherds of the following types: plain brown-paste; polished red-slip; Tularosa fillet-rim; Tularosa Black-on-white

2 bone awls

cylindrical gaming sticks or counters

Artifacts, either Pueblo or Basket-maker

small corncobs; squash rinds; gourd rinds

yucca-fiber cordage

reed cigarettes; knotted twig paho; unpeeled twig pahos

pink shell gorget

Artifacts, Basket-maker

heavy, pointed, wood dart foreshaft; spur end of dart

Cliff Ruin 2, West Fork, Gila (figs. 9, 12, 58, *b*). A 2-room house was built in a cave 4 miles above the National Monument, on the south side of the canyon, in a picturesque portion of the West Fork. The cave is 22 feet wide by 17 feet deep; north room, 13 feet wide by 11 feet deep; south room, 8 feet wide by 8 inches deep. The exposure is to the east. As usual, vandals have torn out walls and pulled down the small pole roof above the north room that was made necessary by the height of the cave ceiling in this part of the shelter. Well-built walls were made of flat stones laid in hard caliche mortar. The walls of the south room extended to the roof, and at the central door were 6 feet 10 inches high. Imbedded in the masonry, to strengthen the partition wall, were 3 upright posts 6 to 8 inches in diameter. Similar posts were set 16 inches apart on either side of a breach near the north side of the north room's front wall. No lintel was in place. These could have been reinforcements of the masonry or might have been set as casings for a doorway or a window. In the front wall of this room, next to the partition, was a central door 1 1/2 feet wide by 4 feet high, with a woden lintel. Another opening, 1 foot 5 inches wide and 5 1/2 feet high to the cave roof, gave access to the south room at the back end of the partition. In the south room there had been a window approximately 1 foot square. There was a 4- by 6-inch niche in the inner front wall of this room, 2 feet above the floor. In the front wall of the north room were 2 rectangular peep-holes, or ventilators, 6 by 8 inches and 4 by 5 inches, with stone and wood lintels. One was 2 feet and the other 6 feet 4 inches above the bottom of the wall. On the fairly level stone floor of the cave, which was not plastered, was some refuse containing Pueblo specimens. The construction of the 2-room house can be better visualized by examining the sketch in fig. 12.

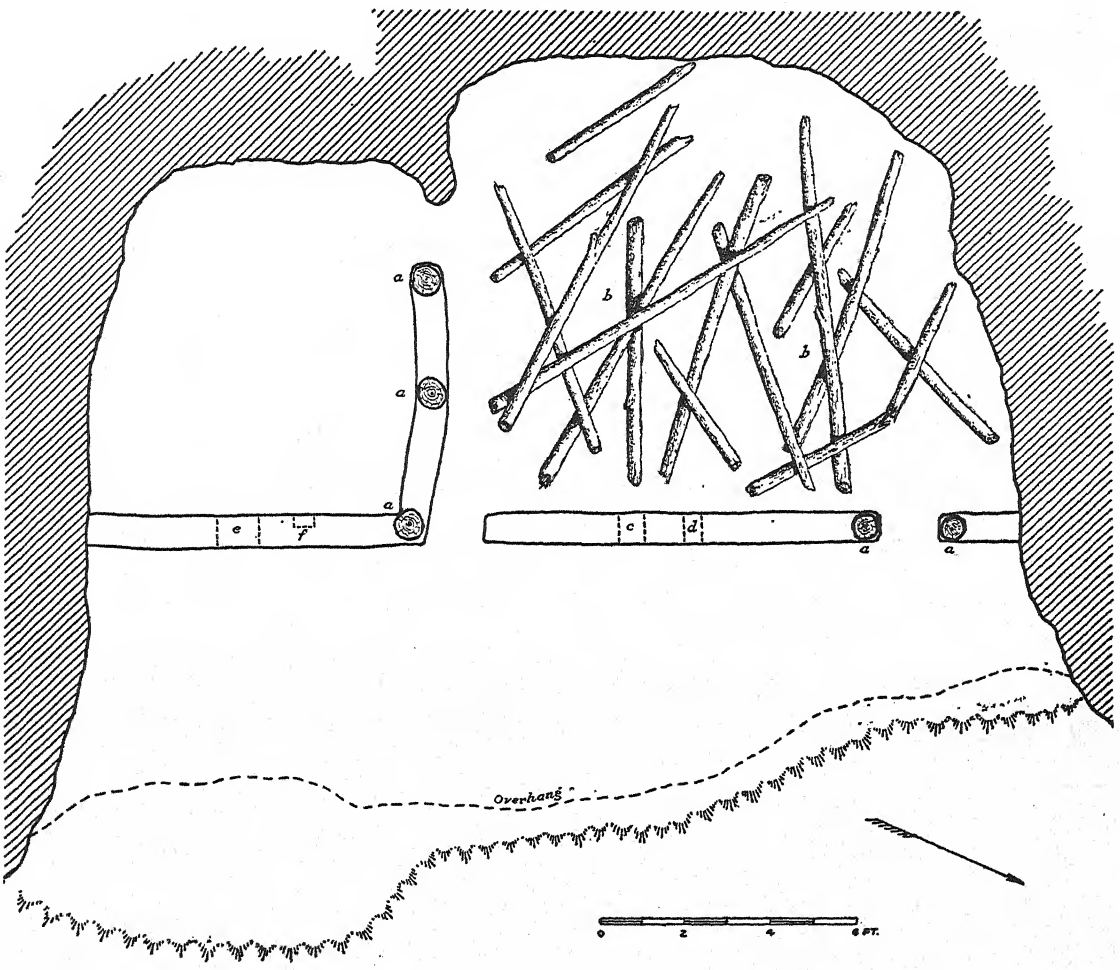


FIG. 12. Cliff Ruin 2, West Fork, Gila River, Catron Co., N. M. *a*, reinforcing posts placed in walls; *b*, fallen roof poles in north room; *c*, small ventilator, 2 feet above floor; *d*, ventilator, 6 feet 4 inches above floor; *e*, window in south room; *f*, niche in inner front wall, 2 feet above floor.

Artifacts, Pueblo

small corncobs
broken reed arrows; arrow foreshafts
cotton cord; yucca-fiber cord; plain-weave yucca-fiber cloth; knotted yucca fiber
plain brown-paste sherds
large flint flake skinning knife
antler prong

Cave 3, West Fork, Gila (figs. 9, 58, *a*). This adjoins Cliff Ruin 2, 4 miles above the National Monument. Because of its steeply sloping floor, it was never occupied.

Cave 4, West Fork, Gila (fig. 9). This site lies across the canyon from Cave 3, high in the north wall. It had been occupied but since that time the floor had slid into the canyon. Nothing was found in this site but a rubbing stone, on what remained of the floor.

SAN FRANCISCO RIVER DRAINAGE

Saddle Mountain Cliff Ruin (Sec. 16. Town. 8 S., R. 21 W., Catron Co., N. M.). This cliff ruin is at the southern point of Saddle Mountain, between the forks of Pueblo Creek, a northern tributary of the San Francisco (fig. 13). High in a cliff of conglomerate, facing south, is a fortified cave 12 feet high, 30 feet wide at the front, and 25 feet deep (fig. 59, *a*). The floor is level and

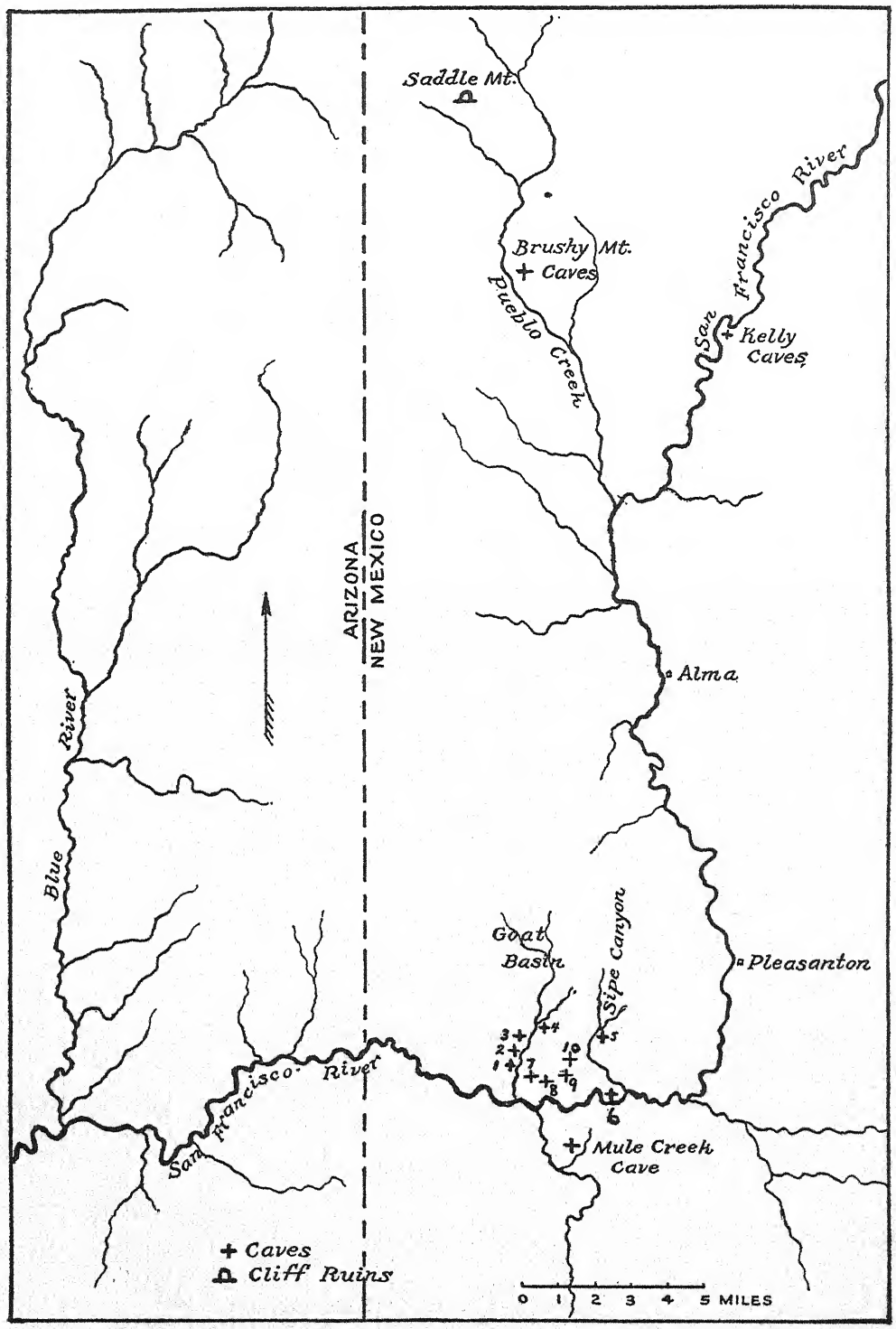


FIG. 13. Cliff ruin near Saddle Mountain and caves on Lower San Francisco River drainage, Catron Co., N. M.

covered with spalls from the roof. Across the front is a good wall of adobe and rock masonry, standing 6 to 7 feet high, but not extending to the roof of the cave. In the wall at different points are 6 rectangular portholes about 1 foot square, and at the east side is a breach in the wall, which at one time may have been a finished doorway. The cave is 18 feet above the top of the talus and has to be reached by a ladder (fig. 59, *c*). The floor of a small cave to the east, and under the same overhang, is composed of a chalky, soft material. In it are cut trail-like patterns, 4 human footmarks, what appeared to be bear tracks, and some turkey tracks (fig. 52, *b*). Below the cave at the top of a small level portion of the talus is a shallow pocket under which camps had been made. Underneath the loose rocks and refuse on this level some sherds were found; also an infant burial, without offerings. The cliff ruin above had been entered by cattlemen about 25 years before, and we were told that they found bows, arrows, and other objects, and very likely pottery vessels, since sherds were picked up in the cave. Hough mentions this site, numbering it 64 and stating that a ranchman, John Casper, said he "found bows, arrows, painted *tablitas*, arranged in an orderly manner around the walls of the cavern, and that it was thought the place had been used by the Indians as an armory." Dr. Hough thinks this a place for "sacrificial offerings."[8] Even though the cave is almost inaccessible, with living water 1200 to 1300 feet below, the carefully built masonry pierced by portholes seemed to indicate that at times it was used as a place of refuge as well as a shrine.

In the cave and adjoining small recess there remained a few fragmentary specimens. Among these were what seemed to be parts of a tree-shell trowel and fragments of human-hair string. These give the only possible indication of the Basket-maker in an otherwise Pueblo site.

Artifacts, Pueblo

small corncobs

6 fragments of painted and unpainted large bows; fragments of reed arrows

yucca-fiber cordage; knots of yucca fiber

painted twig pahos; 5 miniature ceremonial bows

sherds of the following types: plain brown-paste (heavy olla); Tularosa fillet-rim; Tularosa Sharp Corrugated; Tularosa Waved Corrugated; Saint John's Polychrome; matte black on cream slip interior, black outlined with white on red-slip exterior (Little Colorado)

2 flat-face, unshaped metates

Artifacts, either Pueblo or Basket-maker

12 reed cigarettes; wooden *tablitas*

Artifacts, Basket-maker

human-hair cordage

part of a tree-shell trowel

Brushy Mountain Caves (Sec. 11, Town. 9 S., R. 21 W., Catron Co., N. M.). These caves are on the southern extremity of Brushy Mountain, on the east side of Pueblo Creek (fig. 13), and are situated one above the other, with a southwestern exposure. The upper opening is 15 feet wide and 8 feet deep. On the clean rock floor was a bed of bear grass and piñon boughs. The lower cave is 20 feet wide and 12 feet deep. This shelter was interesting because the floor contained pits sunk 2 to 2 1/2 feet into the fill, some being circular and 5 feet in diameter. Three were oblong, 4 feet wide and 7 feet long. The place had been dug into by others and was much disturbed; however, enough remained to show that the pits had been used for beds, as they had linings of bear grass, leaves, and bunch grass. Two pieces of bucksin were found on the bottom of 1 pit. The presence of sleeping pits, or cists, although not outlined with flat stones, suggests Basket-maker occupancy. However, the contents of the cave showed it to have been a Pueblo camp site.

Artifacts, Pueblo

very small corncobs; good-sized kernels of white corn; large corncob with hole drilled in stem end; red bean; yucca seeds; mescal quids; piñon nuts

reed arrow foreshafts

knotted yucca leaves; loosely twisted heavy yucca-fiber cord; piece of horsehair rope (probably of late Indian or Mexican manufacture)

2 pieces of tanned backskin; buckskin thong

sherds off the following types: smoothed red-brown-paste; a plain white-paste; Tularosa Black-on-white; black-on-white

6 irregularly shaped metates of medium size with flat face worn slightly concave

notched and severed stick; 2 chunks of resin

bone awl

Kelly Cave (Sec. 14, Town. 9 S., R. 20 W., Catron Co., N. M.). This series of caves, all but

[8] Hough, 1907, pp. 57–58.

one shallow shelters, is on the Pat Kelly Ranch, on the east side of the San Francisco, in a cliff 150 to 175 feet above the stream (fig. 13). All face west except the large cave, which is in an angle with southern exposure. The canyon, although narrow here, has some tillable ground upon which crops are irrigated at the present time.

The large cave is 60 feet wide by 33 feet deep, with a 12-foot ceiling and with sides sloping to a central pit in the rock floor. The shelter had been dug into by R. C. Eisele, of Fort Bayard, New Mexico, who found part of a large twined-woven Basket-maker bag, a piece of which is shown on figure 79, *g*. He also dug out of the refuse 3 large, bundle-weave baskets, similar to Pima storage baskets, one of which contained 92 pounds of small white beans. By going through the disturbed refuse, which originally must have been 4 to 5 feet deep in the center of the cave, we recovered a number of artifacts.

The large amount of accumulated refuse containing fragile Pueblo specimens, Tularosa sherds, early Mimbres sherds, which are representative of a culture preceding that of the San Francisco River district and, finally, Basket-maker artifacts point to this site as a domicile of long standing.

Artifacts, Pueblo

large corncobs; large red and white kernels of corn; beans; food bones (deer)

fragments of reed arrows; arrow foreshafts

cotton cordage, some dyed black and red

sandals of the following types: 6 Type 9*a*, 2 Type 11, 1 Type 12, and 1 Type 13

bundle of bark and willow splints; coiled twigs (potrest)

twilled-woven bear-grass matting

fragment of miniature ceremonial bow

sherds of the following types: medium-smooth brown-paste (bowls, ollas, and seed bowls); red-slip polished, red-brown plain; Mimbres Rubbed Corrugated; Mimbres Sharp Corrugated; Mimbres Rubbed Indented Corrugated; Mimbres Rubbed Corrugated red-paste; Mimbres Bold-face Black-on-white; Mimbres Classic Black-on-white; Tularosa smooth brown-paste, polished black interior; Tularosa Corrugated; Tularosa Black-on-white, tick edging on solid triangular element

perfected flat-channel (Type 4 Swarts) metate; oblong flat manos; fragment of stone tablet or plaque

potter's tool or incisor, fashioned by hafting a piece of gourd rind in an arrow foreshaft

fragment of *Glycimeris* shell bracelet

Artifacts, either Pueblo or Basket-maker

small corncobs; corn stalks; squash rinds and stems; gourd rinds

fiber cordage, some dyed black; coarse shredded yucca-leaf carrying net (full-turned coiled netting); decorated yucca-fiber headband; hank of yucca fiber; shredded and knotted yucca fiber

strips of sinew; shredded bark and grass bedding

twig pahos, feather or fiber cord attached

stone scrapers; hammerstones

fire drill; digging stick; pointed sticks; sticks showing sectioning; twigs cut in short lengths; pitch daubing stick

handle for gourd rattle

bone flaking tool; flat bone scraper

Artifacts, Basket-maker

3 dart foreshafts, two of them with broken stone points; spur end of dart

fur cloth

piece of red and black decorated twined-woven bag

1 complete tree-shell trowel and 2 fragments

Numbers of caves were found farther down the San Francisco, west of its turn toward Arizona. One is in the river canyon itself, and the rest are in the cliffs high above the river and in the tributary Goat Basin and Sipe Canyons coming from the north. They are numbered 1 to 10 and lie along the southern sections of Town. 12 S., R. 20 and 21 W., Catron Co., N. M. Included in this group is Mule Creek Cave, situated in a canyon of that name which enters the San Francisco River from the south. Caves 1–4 are in Goat Basin Canyon; four more containing no signs of occupation were not given numbers. Caves 1–3 are on the west side of the canyon, 1/2 a mile above its entrance into the San Francisco. The mouth of Goat Basin Canyon is 1/3 of a mile below that of Mule Creek, which enters the San Francisco from the south. The caves are in a red volcanic stone cliff facing southeast, and at the top of a steep talus slope, 150 to 200 feet above the bottom of the canyon, which boxes at this point. Approach to them is difficult from the river, and none too easy following a trail west from the settlement of Pleasanton over broken, lava-capped mountains and down the canyon from the north.

Cave 1, Goat Basin (figs. 13, 14). This cave is farthest south in the group. The original width of the opening was 106 feet; greatest depth, 70 feet; height, 12 to 15 feet. The front of the arched roof had fallen, almost closing it with great blocks of stone, but leaving a 15-foot entrance at

the south and a narrow passage at the north. Nothing was found around or below these boulders, as water from above now keeps the ground wet at that point. Years ago the cave was dug for guano, which was sent on muleback to Clifton, New Mexico. The result was a complete churning up of the fill and no doubt the destruc-

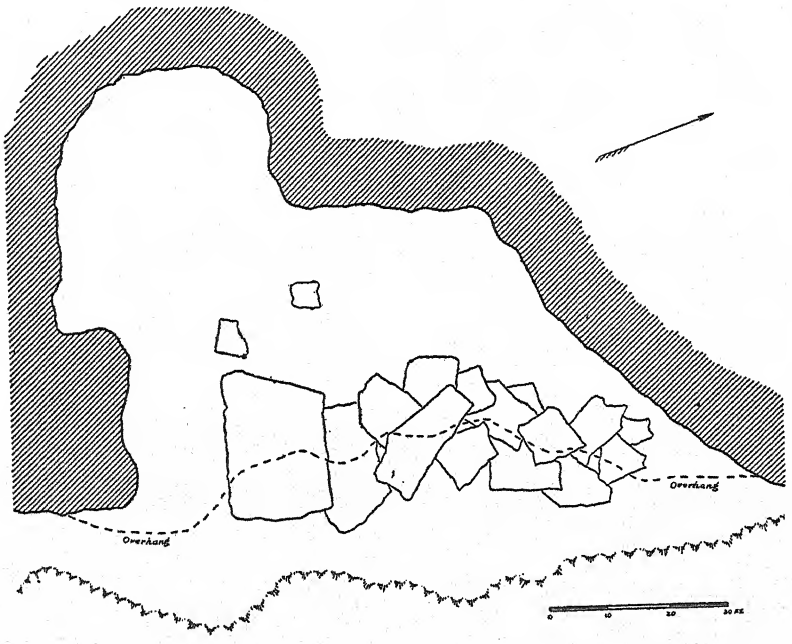


FIG. 14. Plan of Cave 1, Goat Basin, San Francisco River drainage, Catron Co., N. M.

tion of many valuable specimens. Our collection came mostly from the refuse shoveled back by the guano-diggers, which subsequently became covered by manure left by cattle seeking protection from flies at certain seasons of the year.

The recovery of some fur cloth, a yucca-plant basket or container, and especially a dart foreshaft indicates the former presence of the Basket-maker. The plain olla sherds and metates confirm that the shelter was at times occupied by the Pueblo, but from the number of ceremonial bows and pahos found, it seems to have been used principally as a shrine. The absence of fragmentary wooden *tablitas* among the offerings here and in other caves on the north side of the San Francisco was peculiar, since so many were found on the south side of that stream.

Artifacts, Pueblo

large corncobs, some with stick thrust in end
6 pieces of large bows; 191 fragments of reed arrows, some complete; arrow foreshafts
cotton cordage; narrow braid of yucca-fiber cord
sandals of the following types: 1 Type 9*a* and 3 Type 14
basketry fragment of two-rod-and-bundle triangular foundation, wood-splint sewing element; bundle of basketry rods
twilled mat
cylinders of pith; grass-stem pahos; painted twig pahos; 55 painted stub pahos; 10 unpeeled stub pahos; crook-staff pahos; 2 arrow pahos; 13 complete ceremonial bows and 61 fragments
medium-smooth brown-paste sherds (olla and bowl)
flakes of obsidian; oval-depression metate; flat-face metate

Artifacts, either Pueblo or Basket-maker

small corncobs
fiber cordage
unpeeled twig paho
buckskin
red oxide
incised rod; wooden cylinder

Artifacts, Basket-maker

sharpened wooden dart foreshaft
fur-cloth fragments
small yucca-plant basket or container

Cave 2, Goat Basin. North of Cave 1 is an irregularly shaped, low-roofed shelter 30 feet wide by 10 to 12 feet deep. At the south end a room or barricade had been built, as shown by the broken lower courses of a rubble wall, 15 feet long at the front, which turned at right angles to the back wall of the cave. No specimens were found.

Cave 3, Goat Basin. North of Cave 2 is a well-lighted Pueblo shelter 50 feet wide, 30 feet deep, and 14 feet high. It had been previously dug over, but some grass bedding, part of a coarse fiber carrying net in the trash, a flat stone with smoothed side, and 3 oval-depression metates were found on the surface. These, and the absence of cult objects, indicate a camp site and not a shrine.

Cave 4, Goat Basin. Across the canyon from Cave 3 is a small Pueblo cave with a southern exposure.

Artifacts, Pueblo

parts of reed arrows
3 painted stub pahos
sherds of the following types: plain brown- and red-paste; Mimbres Sharp Corrugated; Mimbres Classic Black-on-white; Mimbres Bold-face Black-on-white; Tularosa Fine Corrugated
fire hearth
point of bone awl

Cave 5, Sipe Canyon (fig. 13). This is a low-roofed cave with southern exposure, 2 miles up Sipe Canyon, on the north side of the San Francisco and east of Goat Basin Canyon. This was the only cave discovered that was apparently undisturbed, and it proved to have been a camping place of both the Mimbres and Tularosa people. Some sandals were scattered on the rock floor, and in a small amount of rubbish among the rocks at the north end a few specimens were found.

Artifacts, Pueblo

small corncobs, 1 on a stick; squash rind; gourd rind fragments of reed arrows
cotton cordage; fiber cordage; plain-weave cotton cloth; knotted coarse yucca-fiber straps
sandals of the following types: 3 Type 9*a* and 6 Type 9*b*
2 painted stub pahos
sherds of the following types: rough brown-paste; red-wash, red-paste; Mimbres Sharp Corrugated; Mimbres Rubbed Corrugated; Mimbres Classic Black-on-white; Mimbres Bold-face Black-on-white; Tularosa Corrugated; Tularosa fillet-rim
fire hearths; twigs showing sectioning
sharp-edged flake knives; arrow straighteners

Cave 6, San Francisco Drainage (fig. 13). A short distance below the mouth of Sipe Canyon is Cave 6, a tapering hole 4 feet in diameter at the mouth and 12 feet deep. It is in the vertical north wall of the canyon 13 feet above the stream. As the canyon is 200 yards wide at this point, the floods never entered the cave, and a fill 1 1/2 to 2 feet deep, consisting of clean down of sycamore seed balls and leaves, was perfectly dry. This inconspicuous shelter was one of the most important in the district, as it proved to be a cache-site of long standing, since in the upper layer of the fill were Pueblo articles, and lying on the rock bottom of the cave were Basket-maker darts.

Artifacts, Pueblo

2 reed arrows
half of a Tularosa fillet-rim bowl

Artifacts, either Pueblo or Basket-maker

medium-size corncobs
small rod made from a tree branch, scored its entire length with zigzag and cross channels
small turtle shell

Artifacts, Basket-maker

2 hardwood darts; 3 battered dart foreshafts; 2 fragments of grooved fending stick

Caves 7–10, numbered from west to east, are along the base of the creamy-white volcanic cliffs of Table Top Mountain, north of the San Francisco and east of the cliffs containing the caves in Goat Basin Canyon. Caves 7, 8, and 9 face south, and 10 is around the point, facing southeast. They are in a sightly location overlooking the San Francisco (fig. 59, *d*), but being 900 feet above water, they were suitable only as camps for hunting parties on their way to the pine- and juniper-covered parks above. Judging from their contents, they are undoubtedly Pueblo sites.

Caves 7 and 8, Table Top Mountain (fig. 13). These caves average 15 by 20 feet in size, with low ceilings 5 to 6 feet high. The entrance to them is almost closed by fallen rock. A plain brown sherd and a stub paho were found in Cave 7; and in Cave 8, a broken reed arrow and part of a squash-rind container, drilled for mending.

Cave 9, Table Top Mountain (fig. 13). This cave is 25 feet wide, 50 feet deep, and 15 feet high. It has a finely arched opening and roof. In the loose spalls and dirt on the floor in the middle of the cave near the west wall was a sleeping pit, or bed, 5 by 6 feet, outlined with piled stones to break the draught. The pit was first lined with bear grass, above which was a padding of soft bunch grass. Another pit, about the same size, widens from the entrance and has a high, domed roof. No signs of occupation were seen here.

Mule Creek Cave. (Sec. 7, Town. 13 S., R. 20 W., Grant Co., N. M.). This cave (fig. 13) is 1/4 of a mile above the mouth of a short canyon coming into Mule Creek from the northeast. The outlet of the canyon is 2 miles above the entrance of Mule Creek into the San Francisco. The cave faces south and is in an almost inaccessible loca-

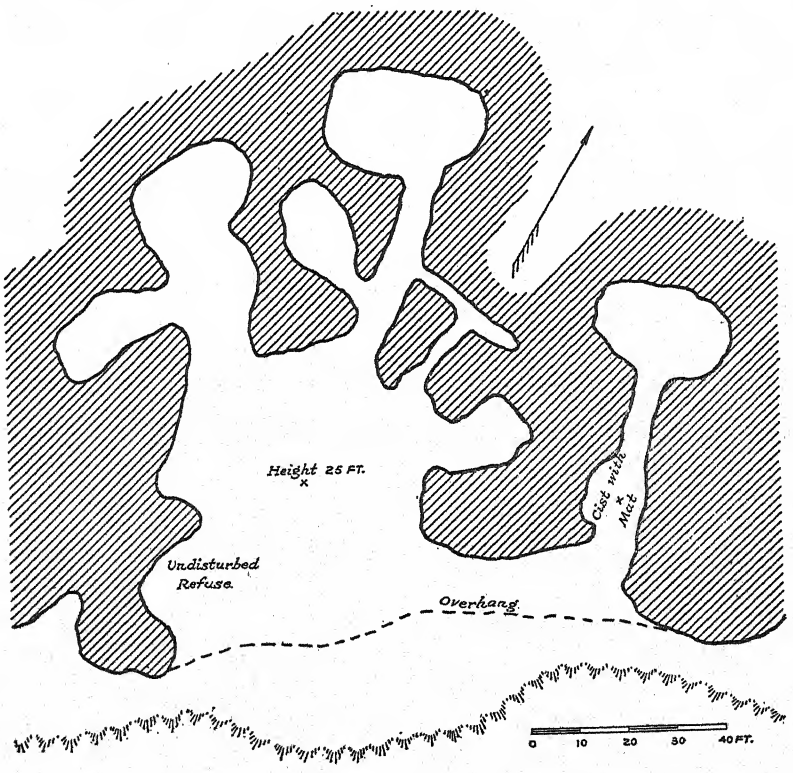


FIG. 15. Plan of Mule Creek Cave, San Francisco River drainage, Catron Co., N. M.

was found in the back of the cave. The bottom of this was lined with sotol leaves covered with soft grass. In the center of the cave was a storage pit containing fragments of a large loosely twilled sotol leaf container. In the pit were part of a twilled mat of finer weave, a heavy yucca-leaf knotted strap, fragments of reed arrow, a plain sherd, small corncobs, large kernel of corn, and some acorns. On the cave floor was a large flat stone, rubbed smooth by grinding.

Cave 10, Table Top Mountain (fig. 13). The cave is around the point of the rimrock. It is 15 feet wide at the entrance and 45 feet deep. It

tion at the base of a cliff 900 feet above Mule Creek Canyon (fig. 59, *b*). It is quite large, with an overhang 106 feet long and a maximum depth of 110 feet. There are 3 main drifts each with lateral branches and irregularly shaped pockets (fig. 15). The ceiling at the center of the main chamber is 25 feet from the floor; the roofs of the drifts are 8 to 10 feet, or even less, in height. The formation is a coarse conglomerate, and the mouth of the cave was banked with dirt washed from above. This obstruction had caused water to seep back through the refuse at the front and, in places, to rot numbers of buried objects. In previ-

ous years the cave had been sadly disturbed by curio-seekers and by guano-diggers. Parts had even been set on fire, with additional damage to artifacts. Trampled and broken specimens were found in all the drifts. A pocket of undisturbed trash at the west side of the cave, near the entrance, and pits below the fine dust near the front of the tunnel at the east were the only places that had not been dug. The inaccessibility of the site and the fact that it contained only 1 corncob and practically no ash deposits indicate that it was occupied only temporarily. These visits dated far into the past and continued up to comparatively recent times. Near the entrance to the east drift was a pit suggestive of Basket-maker or, at the latest, very early Pueblo. It was lined with grass and shredded cedar bark and contained diminutive corncobs. Near this was a pit 1 1/2 feet deep by 4 feet in diameter, lined on the bottom with bear grass, above which lay a large mat of tule formed by piercing the rush with wide spacings of yucca-fiber cord weft and by finishing a side selvage with 2 twined courses of the same cordage (fig. 106). Lying on the mat were a shredded yucca-fiber Type 11 sandal, a bear-grass-leaf container (fig. 102, *a*), a leaf container (fig. 102, *d*), and part of a fur-cloth blanket.

Literally hundreds of objects were found throughout the cave: painted pahos, ceremonial bows, reed cigarettes, and reed arrows with wrappings of string to hold feathers, and quantities of other votive offerings. These suggest that this was a shrine visited for centuries by Pueblo people.

Artifacts, Pueblo

2 complete large bows and 7 fragments; 365 complete and broken reed arrows, some of the wooden foreshafts tipped with obsidian points, most of the foreshafts simply pointed (some wooden foreshafts carved with points in imitation of obsidian tips); 3 sets of arrows

cotton cordage, some in hanks; plain-woven cotton cloth (1 specimen in the shape of a quiver); cotton bands, twilled-weave; lace band; weft-wrap openwork

sandals of the following types: 7 Type 9*a*, 5 Type 9*b*, and 1 Type 11

basketry fragments of two-rod-and-bundle triangular foundation, wood-splint sewing element; basketry fragment of two-rod-and-bundle triangular foundation, sotol sewing element

fragment of twilled basket with hoop neck

twilled matting; twilled bear-grass cradle lining

bars of pith pierced with small sticks; decorated ball of pith; gourd rattle; 40 reed cigarettes; grass-stem pahos; painted twig pahos; 2 unpeeled stub pahos; 310 painted stub pahos; crook-staff paho with burned geometric design decoration; 10 roundel-staff pahos; 22 reed arrow pahos; large, painted planting-stick paho; miniature planting-stick paho; 63 perfect miniature ceremonial bows and 111 fragments; 28 miniature ceremonial bow sets, with grass-stem pahos attached; split-stick wands; wooden *tablitas*

fragment of small black olla; Mimbres Bold-face Black-on-white sherds; Mimbres Bold-face Black-on-white bowl

stone scraper; 2 irregularly shaped rubbing stones

fire hearths and drills; planting sticks

gourd containers

bone awl; bone flaking tool

short lengths of cotton-cord paho wrappings on which are strung *Olivella* shells, turquoise pendants, discoidal turquoise, white and black stone beads

Artifacts, Basket-maker

fur cloth; string aprons

leaf basket; basket-like leaf containers

threaded rush matting

hair ornaments

HUECO AREA

As previously stated, the term Hueco area has been extended to include a portion of the Rio Grande Valley in which the following sites excavated by ourselves and others yielded Basket-maker specimens: Bishop's Cap Cave and Chavez Cave near Las Cruces, a cave on the east side of the river near Lava, and Sandal Cave on the west side in Nogal Canyon below San Marcial, New Mexico (fig. 1). The similarity of artifacts found at these places and in the Hueco Mountains justifies the addition of territory lying between these extremes and east of the Rio Grande—an area including the Organ, Caballo, and San Andres Mountains, all as yet unexplored—where more caves and shelters containing evidence of the Hueco Basket-makers are sure to exist. This is very likely true also farther east of the Rio Grande in the Sacramento Mountains. Likewise the territory of the Playas Valley in extreme southwestern New Mexico must be included in the Hueco area, since 2 sites therein also yielded Hueco Basket-maker specimens.

RIO GRANDE VALLEY

As a rule caves or overhangs in the mountains bordering the Rio Grande as far north as San Marcial are well sheltered while those along the western foothills of the Hueco Mountains are less protected from the prevailing northwest winds and storms.

Sandal Cave (Town. 9 S., R. 4 W., Socorro Co., N. M.). The cave is 15 miles in a direct line southwest of the town of San Marcial and 1/4 of a mile up the canyon west of the highway bridge (fig. 1).

The shelter, with a southern exposure, is in the north wall of a limestone cliff, 25 to 30 feet above the creek, which apparently carries water most of the year. The entrance is 26 feet wide; height, 7 to 8 feet; total depth, 76 feet. The front half of the cave was filled with rock fallen from the roof. These partially masked the back chamber, which had a floor 10 to 12 feet lower than the detritus at the front. There were pictographs in yellow and black on the roof at the front, some of them stencils of human hands, others hand prints (fig. 47, *k*).

A few Pueblo artifacts were found near the entrance, and also in the back chamber, where a considerable amount of refuse had been churned up by previous digging. M. R. Harrington named this site Sandal Cave after excavating in it in 1928. He reports finding large cobs of Pueblo corn in upper levels; fragments of reed arrows; fire hearths; bone awls; manos; black-on-white, red-on-black, and corrugated potsherds; also numbers of sandals. The sandals he illustrates are the Type 9 twilled yucca leaves with the tread turned up and over at the heel, a Pueblo type found in the Upper Gila country. At greater depths in the refuse he discovered small primitive-looking corncobs, pieces of atlatl darts, "some still showing traces of feathering, others notched for spearheads."[9]

In 1929, we found no Basket-maker artifacts among the specimens picked up on the surface, but the Harrington finds below the Pueblo debris make this an important site for tracing the trail of the Basket-maker toward the east and down the Rio Grande.

Artifacts, Pueblo

nock end of reed arrow; 2 arrow foreshafts, notched for stone tip

fragment of yucca-fiber cord

5 well-smoothed brown-paste sherds

fire hearth and fire drill to fit in reed; section of reed

For artifacts, Pueblo and Basket-maker, found at this site by Harrington, see above.

Chavez Cave (on the west side of Town. 22 S., R. 1 E., Dona Ana Co., N.M.). This cave is 7 miles in a direct line northwest of Las Cruces, and on the west side of the Rio Grande, north of Picacho Mountain (figs. 1; 61, *b*). It is believed that the original north line of the old Mesilla Land Grant passed approximately through the site. It is on land formerly controlled by the father of Jacob Chavez. In 1926, Jacob Chavez, who has the usual mania for hunting buried treasure, had employed 8 workmen for a period of 5 weeks to dig in the cave, and the men had tunneled under most of the fallen boulders and generally churned up the refuse. Years before, the body of an Indian had been found in the cave (see p. 161).

We persuaded Chavez to give us some of the specimens his men had taken from the cave. Among these were a stone axe, a heavy, sharpened stick, a miniature planting stick incised with zig-zag lines, a small spear-thrower (which Chavez called a fiddle-bow), a sandal, and some fragments of baskets.

The cave is in the box of a short canyon of the foothills, about 1/5 of a mile from the river and within easy reach of tillable land in the valley (fig. 61, *a*). The width of the opening is 143 feet; greatest depth, 82 feet; height of arch at center, 20 feet. The outward-sloping floor against the back wall is on a level with the top of the arch (fig. 16). It has an eastern exposure and is in a loose conglomerate formation that rests on a stratum of hardened white sand which breaks off in blocks, yet is too soft to be called stone. Such poorly consolidated roof material with its soft underpinning made the cave a rather dangerous place in which to work. Huge rocks dislodged from the roof occupied the southern part of the cave, those at the north side were not so large and could be moved down the sloping, hardened sand floor as excavations proceeded from the front to the back wall of the cave.

After going through the disturbed refuse and collecting fragmentary specimens, we found an undisturbed area, 4 to 5 feet in width, between

[9] Harrington, 1928a.

the back wall and the largest boulder (marked X on the ground plan) which lay on top of the heavy rock fall from the roof. Here, and against the north wall, and below the slabs in that area, finds of Basket-maker artifacts were made. The atlatl, according to Chavez, was found in front of the largest pile of boulders, 5 feet below its lower edge. In our collection there are only a few twig pahos to indicate that the place ever served as a shrine. Behind the large rocks, and at levels corresponding to those where Basket-maker artifacts were found, were 2 large planting sticks (fig. 141, *e*, *f*), also a set of 6 sinew-wrapped sticks (fig. 73, *d–i*), each with a buckskin knob at 1 end. These specimens, though not identical with northern artifacts, appear to represent localized types of Basket-maker agricultural implements and weapons. Two types of sandal—one a 2-warp fish-tail; the other a 4-warp Hueco Basket-maker scuffer toe—we found for the first time here. The Pueblo artifacts were expected, but those of undoubted Basket-maker origin were surprising. They are important, as their presence adds another connecting link in tracing migrations of the Basket-maker.

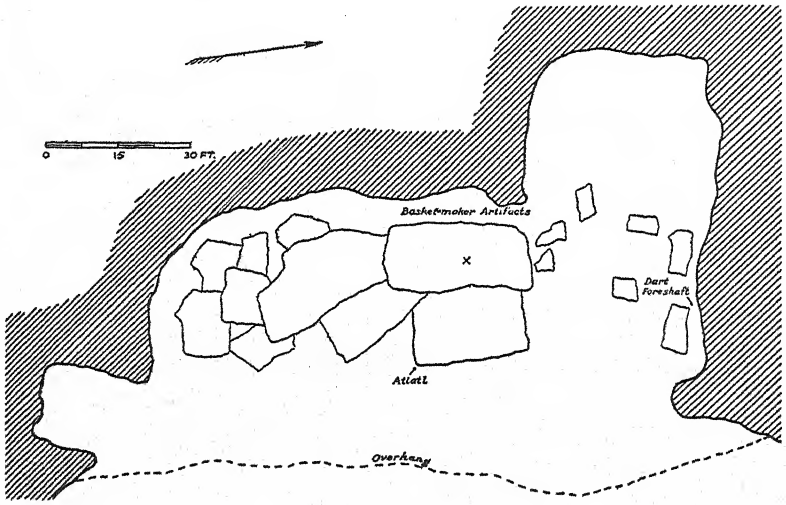


FIG. 16. Plan of Chavez Cave, Dona Ana Co., N. M.

Artifacts, Pueblo

nock ends of reed arrows; 17 reed arrow shaft fragments

wooden hoop for ring basket

medium-smooth red-brown-paste sherds; pottery disc of same ware; roughed-out pottery spindle whorl of same ware

three-quarter-grooved axe of basalt (channel across the pole)

bone weaving tool

human patella (probably from the desiccated Pueblo or Plains Indian body taken out years before)

Artifacts, either Pueblo or Basket-maker

small corncobs (some on sticks); cornhusks; agave-fiber quids; squash rinds; gourd rinds; food bones (deer, antelope, rabbit, duck, fish)

yucca-fiber cordage; animal-hair cordage; hank of very fine fiber cord; yucca-fiber netting of 5 different mesh sizes; narrow woven-fiber band; small fiber ring

binding of willow withes (appears to have held rods as in a Papago carrying basket)

2 turtle-shell rattles; reed cigarettes; painted peeled twigs; unpeeled twig pahos; twigs and round-stick pahos with wrappings of fiber, cord, sinew, and buckskin

buckskin; fragment of porcupine skin

4 hammerstones; 2 small mortars (one of tuff, other of basalt); 6 irregularly shaped rubbing stones; rectangular rubbing stone of sandstone, both sides having 2 beveled faces worn from a median line; stone ball; piece of hematite

wooden awl; fire hearths and drills; hafting of willow for stone club; small pointed sticks; shredded bark

bone awls; smooth and notched bone

cylindrical gaming sticks or counters

Artifacts, Basket-maker

small ear of Tropical Flint corn

atlatl; spur end of dart; pointed wooden dart foreshaft;

dart foreshaft with stone point; dart foreshaft in process of manufacture; fragment of grooved fending stick; set of 6 sinew-wrapped fending sticks; heavy, pointed, hardwood stick (more like a weapon than a planting stick)

fragments of fur cloth (no feather cloth found); human-hair cordage; large coiled-netted bag of yucca-fiber cord; narrow yucca-fiber woven band (spirally wrapped warps); small twined-woven bag of yellow and red yucca cord, dry-dyed

toe sandals of the following types: 8 Type 1, 1 Type 2, 3 Type 3, 4 Type 4*a*, 1 Type 4*b*, 5 Type 5*a*, 4 Type 5*b*, 1 Type 5*c*, 6 Type 5*d*

basketry fragment of one-rod foundation, yucca sewing element; basketry fragment of rod-with-lateral-bundle foundation, sotol sewing element; fragments of two-rod-and-bundle triangular foundation, sotol sewing element; basketry fragments of two-rod-and-bundle triangular foundation, wood-splint sewing element; basketry fragments of half-rod foundation, yucca and sotol sewing elements; coarse coiled fragments of grass or fiber soft bundle foundation, sotol sewing element; basketry fragments of bundle foundation, sotol sewing element

bundle of *Martynia* pods wrapped with fiber to straighten them; bundle of yucca leaves

tie-twined bundle matting

small buckskin pouch; pouch made of antelope-neck skin, tied with human-hair cordage; bundle of 8 running-noose cord snares; hinge-stick snares

short bone awl (handle wrapped with yucca fiber)

2 tree-shell trowels; 2 large, tornillo, thorn-wood planting sticks; miniature planting stick, scored with zigzag lines

dart-straightening wrench of antler

hair ornaments; beads of reed on fiber cord (reeds sectioned by used of live ember); shell beads on hair cord, dyed blue; shell discs on fiber cord

HUECO MOUNTAIN CAVES

(Twenty-four miles in a direct line northeast of El Paso, Texas, in Town. 27 and 28 S., R. 7, 8, and 9 E., El Paso Co., Texas.) The shelters showing former occupancy generally have a western to southwestern exposure and an unobstructed view across wide, flat plains toward the Franklin and Organ Mountains, above El Paso (fig. 1). They occur in the faces of bays and cuts in limestone escarpments which consist of a 200-foot talus, surmounted by a 250- to 300-foot cliff. Most of the caves are at the foot of the cliff, just above the talus and along a bedding plane which, as nearly as can be judged without an actual survey, appears to follow the same general level throughout the section. The overlying strata seem to have been more soluble and easily acted upon by water, since the tunnels and larger caves, some of them with domed roofs, have their floors and entrances on top of the harder stratum. In places, this forms an outer shelf which affords easy passage from one opening to another. No springs were seen along the cliffs; and the only sources of water, aside from modern drilled wells, which at present supply ranches and the city of El Paso, are natural rain-filled tanks or basins in the cliffs. The sandy and almost desert country is covered with mesquite, creosote brush, and cacti. The creosote brush shows heavier growth in some shallow depressions on the flats, which in favorable seasons may have been filled by run-off from the hills. This would have moistened the ground sufficiently for dry farming on the margins of such shallow reservoirs.

Twenty-eight of the 41 small and large caves shown in the more detailed map (fig. 17) gave no evidence of having been occupied. Some of them may bear excavating, and undoubtedly there are still more to be found in this locality. The principal sites here described are on land owned by Charles M. Newman and were drawn to our notice by Mr. and Mrs. R. B. Alves, of El Paso, who with Colonel M. L. Crimmins have discovered many other caves east of this place at what is localled termed "Hueco Tanks," and in the Cornudas Mountains beyond. As can be seen on the map, two of these (Picture and Ceremonial Caves) had previously been named; the rest were numbered as our excavations were carried on.

Picture Cave (fig. 17). Our camp was established at a point from which a large number of caves were accessible. Picture Cave was 1 mile to the southeast. It is really 2 caves connected by an unsheltered ledge 37 feet long. The southern grotto is 23 feet wide and 33 feet deep to the end of Tunnel 1; the northern part is an open shelter under an overhang 60 feet long, with Tunnel 2, 36 feet deep, at the south side. Throughout the cave are pockets and shallow drifts, in which no refuse was found. On the inner north and back walls of the northern open shelter are numbers of red pictographs of birds, snakes, human figures, and geometric designs (figs. 44, 45). The drawings of snakes are interesting as four of them are good examples of the plumed serpent, one finely decorated with geometric patterns. The cave had previously been dug.

The material from this site, as in many others, points to visits of both Basket-maker and Pueblo people.

Artifacts, Pueblo

large corncob
El Paso Polychrome sherds

Ceremonial Cave (fig. 63, *a*). Ceremonial Cave is situated at the top of the talus near the mouth of a short rough canyon, 1 mile east of the base camp, facing west (fig. 17). The entrance is 27 feet wide, 15 feet high; depth from overhang of line, 90 feet; maximum width, 41 1/2 feet (fig. 18)

The roof of this cave, as in nearly all in this district, was smooth, showing no recent falls of heavy stone. Below the refuse and lying on a yellow sandy fill were blocks of a friable, crystalline formation that had sloughed from the roof long ago. Only 1 cave out of the many explored had this encrustation still adhering to the ceiling. In September, 1926, a hunter had taken refuge in Ceremonial Cave and discovered evidence of former occupation. Later he went back many times and, by digging unsystematically near the front of the cave, obtained some unusual specimens, among which were long darts with pointed wood and flint-tipped foreshafts, grooved fending or throwing sticks, digging sticks, bone awls,

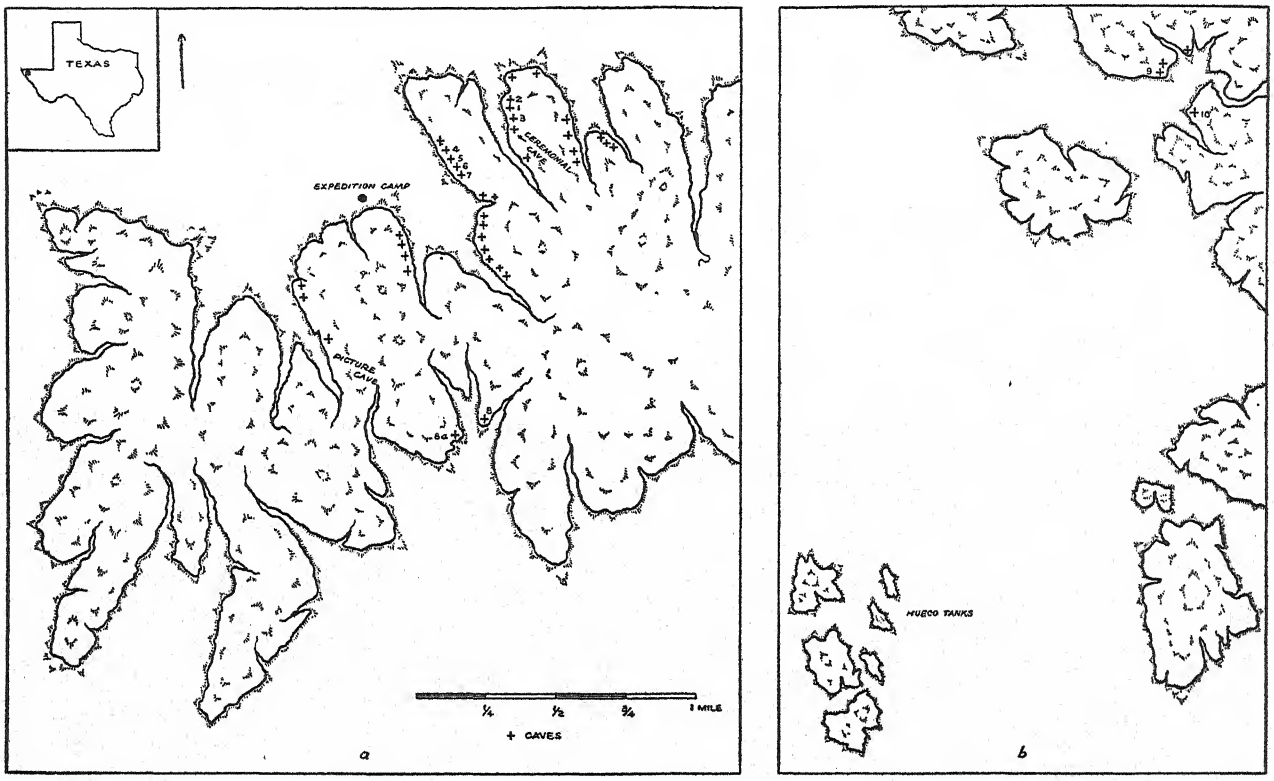


FIG. 17. Hueco Mountain district. Division *b* of map is 2 1/2 miles north and 4 miles east of division *a*.

Artifacts, either Pueblo or Basket-maker

small corncobs
fine and coarse yucca-fiber cordage; knotted yucca fiber
piece of gourd rattle
fire hearth; block of sectioned hardwood
bone awl

Artifacts, Basket-maker

2 pointed, wooden dart foreshafts
fragments of fur cloth
toe sandals of the following types: 2 Type 1*a*, 1 Type 1*b*, 1 Type 2, 1 Type 3, 1 Type 4*a*, 3 Type 4*b*
piece of checkerweave yucca-leaf mat
fragment of hair ornament

sandals, fragments of basketry, shell and stone beads and pendants, a coiled basketry armband encrusted with turquoise mosaic, mosaic-encrusted comb, hair ornaments, ceremonial staffs, and parts of *tablitas*. Fortunately Mr. and Mrs. R. B. Alves, of El Paso, were able to purchase the collection, and it is now carefully catalogued and in safe keeping.[10] The Archaeological and

tity of cactus thorns brought in by rats, this disturbance was not so great. Our excavations varied from 1 to 5 feet in depth, reaching to points below blocks fallen from the roof. The only definite stratum found was a layer of packed grass directly above the barren cave floor. The grass layer, which had been burned in places, extended over the middle third of the cave floor, and above it

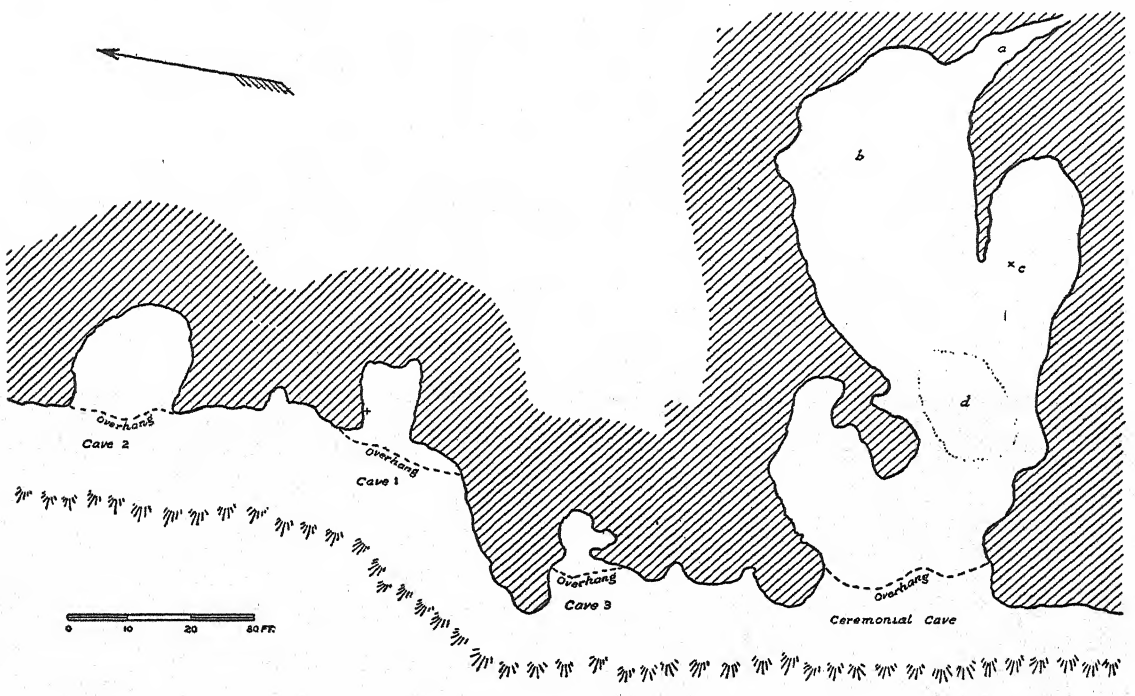


FIG. 18. Plan of Ceremonial Cave and Caves 1–3, Hueco Mountains. *a*, Ceremonial Cave, showing end of refuse and dust-filled drift narrowing as it extended for an unknown distance; *b*, Cave 1, greatest depth of rubbish extending to the back wall (x marks infant and adult Hueco Basket-maker burial); *c*, Cave 2 (x marks adult Hueco Basket-maker burial); *d*, Cave 3, area of large ceremonial deposit.

Paleontological Society of Abilene, Texas, published an address given by Mrs. Alves in which she illustrates numbers of specimens from Ceremonial Cave.[11] Subsequent to this discovery, Mr. F. H. H. Roberts, Jr., visited the site and gathered some objects which he describes in a brief report.[12]

The fill of the cave rose gradually, and at the back was 8 to 10 feet higher than at the entrance, where previous digging had uncovered so many artifacts. At the rear, because of the great quantity of cactus thorns brought in by rats, this disturbance was not so great. Our excavations varied from 1 to 5 feet in depth, reaching to points below blocks fallen from the roof. The only definite stratum found was a layer of packed grass directly above the barren cave floor. The grass layer, which had been burned in places, extended over the middle third of the cave floor, and above it grass, dirt, and loose trash became progressively deeper and more compact toward the back, where rats had nested and had literally cemented the surface together with their droppings. Scattered throughout the fill, and particularly in the deeper parts, were fragmentary and worn fiber sandals to the surprising number of 935. On the surface, and slightly below it, 1 party had previously gathered 100 sandals, and other people had also made collections; so it can safely be stated that a slow accumulation of no less than 1200 to 1300 sandals

[10] This collection is now in the Gila Pueblo, Globe, Arizona.

[11] Alves, 1930.

[12] Roberts, 1929.

had been deposited in the cave. For detailed description of human bones found here, see page 161.

Ceremonial Cave was well named. The entire absence of artifacts for domestic use, of well-established fire hearths or pits, and of any accumulation of food bones was convincing evidence that it had not been a dwelling place. Grass bedding that had been carried in by transient visitors and carelessly fired left a stratum of ash over parts of the cave, but this residue was easily recognized as not being from wood fires used for warmth or cooking. The many articles belonging to the burial of a woman wrapped in a fur-cloth blanket (see pp. 161–62) prove the former presence of the Basket-makers. Signs of later visitors, at least up to the end of Pueblo III times, are shown by the Pueblo reed arrows and an El Paso Polychrome sherd. Miniature grooved throwing sticks, darts wrapped and decorated to be converted into pahos, *tablitas*, and reed cigarettes are a few of the ceremonial objects which indicate that throughout many centuries the place continued to be a shrine of importance. The great accumulation of sandals in association with so many offerings suggests that it was the practice of the people to leave in the cave the footgear worn out in their pilgrimage thither.

Artifacts, Pueblo

4 fragments of reed arrows

basketry fragment of two-rod-and-bundle triangular foundation, fine stitch, wood-splint sewing element

3 pot-rests

sherds of the following types: 2 rough, plain brown-paste, 1 El Paso Polychrome

Artifacts, either Pueblo or Basket-maker

small corncobs, one thrust on a stick; cornhusks; squash rinds; gourd rinds; mesquite beans; yucca seeds; grass seeds; mescal-fiber quids; food bones (mule deer, prong-horn antelope, bighorn sheep, Indian dog, cottontail rabbit, ground squirrel, badger, tortoise, coyote, hawk, great horned owl, California condor); bundle of herbs

11 round hardwood throwing sticks

coarse and soft yucca-fiber cordage; fragments of coarse shredded yucca-leaf carrying nets (full-turned coiled netting); fragment of bottom of bag of knotted coiled netting; 6 fragments of fiber-cord netting; 5 heavy strap loops of yucca leaves; knotted strips of yucca leaves; roll of leaves wrapped with fiber cord; coil of soft grass; 2 yucca-fiber braided bands

2 bindings of unpeeled yucca-leaf withes (appear to have held rods as in a Papago carrying basket); short section of slender strip of yucca leaf serving as a needle, with the rest of the attached strip shredded and twisted into a 2-strand thread

fiber-wrapped tubular bone; 23 reed cigarettes; 5 fiber-wrapped grass-stem pahos; 3 short, pointed, awl-like wooden pahos; paho wrappings of fiber cord holding small quills; 23 unpeeled twig pahos with fiber wrappings; pointed split stick clamped on gut which contains yucca fiber; split-stick wands; several fragments of wooden *tablitas*

8 fragments of tanned buckskin; fragments of rawhide

hammerstone; 2 irregularly shaped rubbing stones; cake of pulverized red oxide; flint core; amphibolite schist pestle, with carrying straps of yucca; 3 flake scrapers or knives (retouched edges)

9 smoothed hardwood tools, round or flattened, some with points; 21 fire drills of sotol bloom stalks (some made from pieces of darts); 1 fire drill of hardwood; hard-wood planting sticks, 4 complete and 24 round, pointed, 20 fragmentary; 10 fragments, rounded, pointed softwood sticks (sotol bloom stalks); 20 small pointed sticks, some of hardwood and some of soft; shavings from dressing and sectioning wood; 58 hard and softwood cylindrical blocks showing sectioning

13 bone awls of various sizes; bone flaking tool; spindle shaft; split metapodial bone; bones of extinct horses and camels also present in the cave, but with no proof of human association

small, discoidal shell beads; *Olivella* shell beads; tubular bone beads; small stone pendants

Artifacts, Basket-maker

kernels of Tropical Flint corn

complete atlatl and 4 fragments, 1 with finger loops; 11 median fragments of darts (sotol bloom stalk); 17 pointed hardwood dart foreshafts; dart foreshaft with stone point; flattened hardwood dart foreshaft to be set in dart end; 9 dart foreshafts notched for stone point (3 in process of manufacture); 4 spur ends of darts (hardwood); 40 spur ends of darts (sotol bloom stalk); 3 distal ends of darts notched for stone point (sotol bloom stalk); 36 distal ends of darts, drilled for foreshaft (sotol bloom stalk); stone point set in dart end; 2 wooden tanged dart bunts; 3 antler dart bunts (cup-shaped); 2 small, tanged, wooden arrow bunts (1 set in reed shaft); complete grooved fending stick and 30 fragments

fur-cloth fragments; fragments of dry-dyed, twined-woven yucca-fiber textile; 3 fragments of braided bands, dry-dyed yucca-fiber cord; narrow band of yucca-fiber cord, twilled-weave; wide woven band of yucca-fiber cord (spirally wrapped warps); elaborate loosely woven wide band of yucca-fiber cord (zigzag twined weft)

923 complete and fragmentary yucca toe sandals (types identifiable were 112 Type 1*a*, 19 Type 1*b*, 1 Type 1*c*, 24 Type 2, 234 Type 3, 14 Type 4*a*, 26 Type 4*b*, 26 Type 5*a*, 11 Type 5*b*, 19 Type 5*c*, 46 Type 5*d*; 68 Type

5e, 4 Type *5f*, 8 Type 7 full-length, 4 Type 8 full-length basketry fragments of one-rod foundation, coarse weave, yucca sewing element; basketry fragments, one-rod foundation, fine-weave, wood-splint sewing element; basketry fragments of rod-with-lateral-bundle foundation, sotol sewing element; basketry fragment of bundle-with-rod-core foundation, wood-splint sewing element; basketry fragment of bundle-with-rod-core foundation, yucca sewing element; basketry fragment of two-rod-and-bundle triangular foundation, wood-splint sewing element; basketry fragments, two-rod-and-bundle triangular foundation, sotol sewing element; basketry fragments of half-rod foundation, yucca and sotol sewing elements; coarse coiled basketry fragments, grass or fiber soft-bundle foundation, sotol sewing element; basketry fragments, bundle foundation, sotol sewing element; bundle of soft grass for bundle-foundation basketry; bundles of split yucca leaves for basketry

2 hoops for splint baskets; oval, pointed basket-bottom or miniature carrying basket

tie-twined bundle matting; fragments of checkerweave matting

3 wrapped fiber balls; fiber bolls and knots from pahos (bolls contain tobacco); 104 fragments of pahos made from sotol bloom stalks, with fiber bolls and wrappings; 2 complete pahos made from sotol bloom stalks, with fiber bolls and wrappings; 25 fragments of darts serving as pahos and embellished with fiber bolls and wrappings of colored cord and fiber; 3 miniature grooved and incised fending sticks

2 hinged-stick snares; 7 running-noose cord snares; pouch made of whole rodent skin; fragment of skin pouch

3 short tubular stone pipes

flint dart points

6 dart wrenches, 5 made from fragment of grooved fending sticks, 1 from large yucca bloom stalks; 2 tree-shell trowels and 7 fragments; 7 flattened hardwood blocks (sections cut off in manufacture of fending sticks); flail for grass seed

short bone awl, end padded with leather

pin hair ornaments wrapped with sinew and fiber string —23 single pin, 11 double pin, 4 triple, and 1 quadruple; 3 single pin hair ornaments bound with fiber to sotol bloom stalk; 22 single pin hair ornaments without wrappings; large, heavy, white gypsum, discoidal stone beads; large, thin, translucent gypsum disc beads strung flat on fiber cord; small, discoidal stone beads; mussel shell pendants; round seeds strung on fiber cord; 2 string and feather ornaments

North of Ceremonial Cave, and accessible from a ledge at the same level, are the small Caves 1, 2, and 3, all having western exposures (figs. 17, 18).

Cave 1, Hueco Mountains. This cave is 12 feet deep with a rectangular entrance 6 feet high and 8 feet wide. The floor was nearly level and was covered with about 2 feet of dust and blow-sand which contained leaves but no grass bedding. In the general fill and from a rat's nest in a pocket at the back, a number of articles were recovered. Near the front of the cave, against the north wall, were the body of an adult male and that of a very young infant wrapped in fur-cloth blankets and accompanied with baskets (fig. 64). For detailed description of these burials, see pages 161–62.

On the basis of the long, undeformed skull, fur-cloth blankets, and coiled baskets—all Basket-maker diagnostics—and the absence of Pueblo offerings in the grave, it is thought safe to call this, and also the burial in Ceremonial Cave, Hueco Basket-maker burials. An El Paso Polychrome sherd in another part of the cave, not connected in any way with the burials, simply indicates that Pueblo visited the place at a later time.

Artifacts, Pueblo

El Paso Polychrome sherd

pebble for polishing pottery

Artifacts, either Pueblo or Basket-maker

gourd rind (1 piece sewed with fiber thread)

chisel-edged, flaked felsite tool without groove for hafting; stone with small quadruped painted upon it

Artifacts, Basket-maker

bundle of herbs

fur-cloth blankets

toe sandals of the following types: Type *1b*, Type *5b*, Type *5f*

complete basket of bundle-with-rod-core foundation, wood-splint sewing element; complete basket of two-rod-and-bundle triangular foundation, sotol sewing element

complete basket of plain checkerweave; fragment of bear-grass checkerweave container

feathered tree-branch paho, resembling dart

leather pollen pouch

2 flint dart points

Cave 2, Hueco Mountains. This is an irregular, low opening 16 feet wide, 6 feet high, and 14 feet deep. The fill consisted of 2 to 3 feet of clean dust and blow-sand, without masses of bedding to indicate occupation; yet apparently the cave had been used at times for shelter. A few specimens were found in the cave fill.

Artifacts, either Pueblo or Basket-maker

delicate bone-splinter awl; 2 antler tips
handle of wooden planting stick

Artifacts, Basket-maker

toe sandals of the following types: 3 Type 1*a*, 1 Type 3, 6 Type 5
basketry fragments of rod-with-lateral-bundle foundation, sotol sewing element

Cave 3, Hueco Mountains. Cave 3 is a small pocket 7 feet deep. It contained some rubbish which yielded a single worn Type 3*a* sandal.

Caves 4–7, all with southern exposure, lie along the same ledge, 20–25 feet above a steeply sloping talus. From the expedition camp they could be seen 1/4 of a mile east, in the limestone cliff, 200 feet above the surrounding country (fig. 62, *a*).

Cave 4, Hueco Mountains (fig. 17). This cave has a rectangular entrance 13 feet wide, 8 to 10 feet high, and 24 feet deep. The roof is horizontal and the floor almost level. It would have made an ideal shelter, yet nothing was found in the clean dust and sand fill lying 1 to 2 feet deep on the floor.

Cave 5, Hueco Mountains (fig. 17). To the east of Cave 4 is Cave 5, which has an oblong rectangular entrance 20 feet wide and 7 to 8 feet high. Originally it had been 51 feet deep, with a fairly horizontal ceiling; but the back half of the ceiling had fallen, depositing a slide of rock on the middle third of the level entrance and leaving at the back an irregular bench, measuring 20 by 32 feet. Above this fall the maximum ceiling height was 10 feet. The tops of the boulders were 17 feet above the level front floor of the cave, and so close to the rear edge of that portion of the ceiling still remaining in position that the opening between afforded only a narrow entrance into the space behind, which was left vacant by the fall.

Against the back wall, and on top of the rock fall, 1 to 2 feet below rat droppings, was a thick bed of fine grass, under which was a large mat, made of small bundles of soft grass held together by tie-twined yucca-fiber weft strands spaced 2 1/2 to 4 inches apart (fig. 105). Specimens from the cave indicate the former presence of both Basket-maker and Pueblo.

Artifacts, Pueblo

4 El Paso Polychrome sherds

Artifacts, either Pueblo or Basket-maker

gourd rind; food bones (deer, antelope, rabbit)
yucca-fiber cordage; fragments of yucca-fiber cord netting; fragments of coarse shredded yucca-leaf carrying net (full-turn coiled netting)
large wooden *tablita* stick, painted red
fragment of buckskin
flint flakes
sectioned hardwood stick

Artifacts, Basket-maker

toe sandals of the following types: 1 Type 3, 2 Type 4*b*
fragments of yucca-leaf container fastened together with twined-woven pieces of the same material
tie-twined grass-bundle mat
piece of tree-shell ladle

Cave 6, Hueco Mountains (fig. 17). East of Cave 5 is an arched opening 11 feet wide and 8 feet high, which quickly narrows to a horizontal drift or tunnel, averaging 6 to 7 feet in diameter and pinching out to terminate in a crevice 41 feet from the entrance. The floor of the tunnel was level and covered with a shallow deposit of sand, dust, and thin spalls from the roof.

There was little definite evidence of the Pueblo, but much that showed the presence of the Basket-maker: dart and foreshafts, atlatl weight, tree-shell trowel, cordage, fur cloth, hair ornament.

Artifacts, Basket-maker

gourd rind
atlatl weight; 2 dart foreshafts, 1 with stone point; spur end of dart
fragment of fur cloth; yucca-fiber cordage, some of it braided; skein of loosely twisted yucca fiber; bundle of straight shredded yucca leaves, tied with fiber cord; coarse knotted yucca-leaf fragments
toe sandals of the following types: 4 Type 4*a*, 10 Type 4*b*, 1 Type 5*a*
fragment of sotol-leaf checkerweave basket
fragment of sotol checkerweave mat
twig wrapped with fiber holding feather quills
large tree-shell trowel; end of pointed hardwood planting stick
slender bird bone awl
single-pin hair ornament wrapped with sinew holding fine feather quills
large turtle shell (aquatic, probably from the Rio Grande)

Cave 7, Hueco Mountains (fig. 17). Cave 7 lies east of Cave 6. It has a triangular entrance 15 feet wide by 7 feet high, opening into an irregu-

larly outlined circular chamber 26 to 27 feet in diameter. The domed roof is 19 to 20 feet above the basin-shaped floor. The fill, 1 1/2 to 2 feet of dry dust, sand, and some stone, had been dug over by others. Leading from this chamber toward the northwest was a tunnel 32 feet long ending in a small circular pocket. The tunnel, 5 feet high, was half filled with dirt upon which was trash brought in by rats. No artifacts were found in this deposit.

Refuse in the main chamber contained some Pueblo artifacts, but none definitely Basket-maker except the fish-tail (Type 4*b*) sandal and some basketry fragments.

Artifacts, Pueblo

fragments of reeds

sherds of the following types: El Paso Polychrome; Chupadero Black-on-white

Artifacts, either Pueblo or Basket-maker

diminutive corncobs

fiber cordage, some dyed red; fiber-cordage netting; knotted fiber strips

twig paho; fragments of wooden *tablitas*, decorated with pitch and red paint

pitch daubers; fire drills

bone awl

Artifacts, Basket-maker

3 Type 4*b* toe sandals

basketry fragments of two-rod-and-bundle triangular foundation, sotol sewing element; basketry fragment of two-rod-and-bundle triangular foundation, wood-splint sewing element

Caves 8 and 8A, Hueco Mountains. These are situated across the mountain, 1 mile southeast of the base camp, at the head of a wide bay in the south side of the western cluster of the Hueco Mountains (fig. 17). Both are 450 feet above the surrounding plains and have an unobstructed view to the south. An old Indian trail passes across from this locality to Picture Cave, previously described.

Cave 8A, Hueco Mountains. This is in a conglomerate rimrock, measures 12 feet wide and 19 feet deep with an opening 6 feet high. A boulder at the front partially screens the southern entrance. The floor is level. The specimens which were found in the small amount of refuse, which contained grass bedding, indicate that this was a Pueblo site.

Artifacts, Pueblo

fragment of yucca-cord netting; fragment of wooden *tablita*

El Paso Polychrome sherds

Cave 8, Hueco Mountains. On the opposite side of the canyon from Cave 8A is a cleft in the conglomerate, formed by water tunneling through from the bench above. It faces south and is high above the bed of the canyon and is reached by climbing over a rock slide from a broken white stratum below the conglomerate cap. The site had been disturbed by others, but among the rocks on the trough-like sloping floor some specimens were found. The almost inaccessible location of the site prevented its use as a habitation. From the objects found, and the sightly outlook, it appears to have been a shrine of importance in Pueblo times and possibly for later nomadic Indians.

Artifacts, Pueblo

broken reed arrow; arrow foreshafts, some pointed and some shaped to receive a stone tip; arrow foreshaft carved with barbed point painted black to represent obsidian tip (another instance found at Mule Creek Cave, San Francisco drainage, Upper Gila)

cotton cordage; yucca-fiber cordage; fragments of cotton net; fragments of yucca-fiber net

pointed unpeeled twigs; pointed peeled twigs; twig pahos with wrappings of yucca-fiber cord; ring paho of devil's claw (*Martynia*) wrapped with fiber cord holding blue downy feathers; split-stick wands; fragments of wooden *tablitas*

El Paso Polychrome sherds

cake of pulverized iron oxide

Olivella shell beads; small, discoidal, white stone beads; fragments of polished turquoise; ornament or paho attachment consisting of a large cotton cord wrapped with vanes stripped from red feathers

Caves 9 and 10, Hueco Mountains. These are both in Texas, 18 1/4 miles southeast of Newman, New Mexico, and 3 1/4 miles south of the New Mexico line. Like the shelters in the vicinity of Ceremonial Cave, 7 1/2 miles to the southwest, which are in outlying groups of the Hueco Mountains, these caves are situated in a short western canyon emerging from the more compact main ridge (fig. 17).

Cave 9, Hueco Mountains. Cave 9, facing southeast, is at the top of the talus, in the north wall of the canyon, 100 feet above its sandy bed, which in places shows moisture. It is a rough

cleft in the rocks 35 feet deep, with a dangerous roof and, in the sloping floor, a series of benches or level spaces left when the cliff-face slipped and settled. A mescal pit on a bench at the foot of the talus proved to be a clue to the occupation of the shelter. There was a small accumulation of refuse among the rocks near the front and on the successive stepped levels above.

Material from this site is of the Pueblo period, as indicated by the quantity of reed arrows. The sandals, with the exception of 3 Type *5a* Hueco Basket-maker toe sandals, are not native to this district, and are the Type *9b* with turned heel, a form and weave found in the Upper Gila country. Apparently a party of hunters from west of the Rio Grande who had wandered out of their territory were besieged in this cave. This is suggested by the discovery at the front of the cave of 48 arrow foreshafts, 44 of them badly broken and splintered by striking the rocks.

Artifacts, Pueblo

medium-sized corncobs; gourd rind; food bones (deer or antelope)
67 broken reed arrows
cotton cordage; yucca-fiber cordage; knotted peeled yucca leaves
complete Type 9 turned-heel sandal and 5 fragments
handle of gourd rattle; arrow paho; fragments of wooden *tablitas*
sherds of the following types: El Paso Polychrome; medium-smooth plain brown-paste
slender hardwood awl
small pointed twigs and sticks
tortoise shell

Artifacts, Basket-maker

3 Type *5a* toe sandals

Cave 10, Hueco Mountains. Near the mouth of a short canyon, southeast of Cave 9. It is 55 feet deep, with a finely arched opening 30 feet wide and 14 feet high. The exposure is to the west. The sandstone floor is somewhat moist, so that most of the perishable objects in a shallow fill of dusty sand and leaves were decayed. This was the only one among the number of caves examined in the district in which a sandstone stratum was encountered below the limestone cap. The site, although an ideal shelter, gave evidence of only temporary occupation by the Pueblo.

Artifacts, Pueblo

small corncobs; food bones (deer or antelope)
nock end of reed arrow; arrow foreshafts, some pointed, others notched for stone tip; grip end of flattened throwing stick
cotton cordage
knotted peeled yucca leaves; bundle of split yucca leaves tied with fiber
sherds of the following types: El Paso Polychrome; plain brown-paste; Mimbres Classic Black-on-white
jasper knife blade 5 1/4 inches long (original wooden hafting indicated by pitch on butt of blade)

PLAYAS DISTRICT

In the Playas district is a series of 6 caves: 3 in the lower Playas Valley, and 3 in the Hachita Valley of southwestern New Mexico.

Cliff Ruin 1, Playas (N. E. 1/4 Sec. 6, Town. 27 S., R. 16 W., Grant Co., N. M.). This cliff ruin (fig. 1) is on the Mangold Ranch, 12 miles northeast of Hachita, New Mexico, on the east side of the Playas Valley. A small rectangular house—the only masonry structure found in the caves of the area—abuts the back wall of this well-lighted shelter facing south. The room is 6 by 10 feet, inside measurements; the walls, which extend 7 feet to the cave roof, are of coarse stone-and-adobe construction. A small door on the front is broken down and is without a lintel. From the west side of the house a loose rock extends south for 12 feet and then, turning at right angles, runs 18 feet along the line of the overhanging cliff to form an enclosed yard. Two milling holes, 12 to 16 inches deep, were found in the rock floor of the house and a shallow one in a boulder outside the building. The site had been dug over, and the small amount of refuse left contained only a few antelope horns and bones. Several shelters along the same broken rim showed no signs of occupancy. All that can be said is that this site is of the Pueblo period.

Cave 2, Playas (N. E. 1/4 Sec. 21, Town. 29 S., R. 16 W., Hidalgo Co., N. M.). This site (fig. 1) is 5 miles north of the Ole Peterson Ranch on the east side of the Playas Valley, and is easily located by its proximity to a red porphyry outcrop near the south west foothills of the Hatchita Mountains at a point due east of the south end of

Playas Lake. In places the perpendicular cliffs of this outcrop rise 250 to 300 feet above the east slope of the valley. At the base of the cliffs on the north side are 6 milling holes of varying depths and, at the west end, 3 more. East of this formarion, in an underlying stratum of limestone, is a cave, measuring 15 by 20 feet, with a small outlet at the back to the surface of the ground. It is 9 feet high at the entrance and has a floor which slopes sharply to the front. The small amount of rubbish in it was partially disturbed. However, a few artifacts were recovered. The cave must have been a temporary camp site used by the Indians of the pottery- and bow-and-arrow-making period.

Artifacts, Pueblo

food bones (deer, antelope, rabbit)
fragments of reed arrows; pointed, wooden arrow foreshafts; arrow foreshafts to hold stone point
plain red-brown-paste rectangular bowl 3 1/4 inches by 4 1/4 inches; fine and medium-coarse, smoothed corrugated sherds of red-brown paste
large flint flakes; 2 flint scrapers
broken *Glycimeris* shell bracelet

Cave 3, Deer Creek (N. W. 1/4 Sec. 17, Town. 33 S., R. 18 W., Hidalgo Co., N. M.). This cave (fig. 1), 6 miles up Deer Creek Canyon above the Culberson Ranch, on the west side of the Playas Valley, had been despoiled. It was 30 feet deep with a northern exposure. Near by was a milling hole in the rocks, and in the cave was part of an oval-depression Type 2 metate. This evidence, with the pieces of reed arrows found in a small amount of refuse, indicates that it was a seasonal Pueblo shelter.

Artifacts, Pueblo

small corncobs
part of a large bow; fragments of reed arrows
basketry fragment, one-rod foundation, yucca sewing element
reed cigarette
piece of rawhide
medium-smooth red-brown-paste sherds, some heavily sooted
flaked stone blade
board (part of a rectangular tree-shell slab punctured by burned holes near edge); fire hearths and drills

Caves 4, 5, 6, Playas (N. W. 1/4 Sec. 11, Town. 33 S., R. 15 W., Hidalgo Co., N. M.). These caves are located near the abandoned Pierce ranch house on the west side of the lower Hachita Valley. All three face east and are in porphyry cliffs of the Alamo Hueco Mountains. These cliffs have been eroded into pinnacles and other odd formations. Seep springs probably furnished, as they do today, a small yearlong supply of water along this short canyon.

Cave 4, Buffalo Cave (fig. 1). This shelter is the northernmost of the series and is named from the 8-foot-long black pictograph of a buffalo painted on the back wall. The cave, 30 feet deep and 50 feet long, is an open overhang, with shallow pockets in the cliff at each side. No masonry was found. Probably the cave was used from time to time as a camp. Mescal had been roasted in pits dug into the floor refuse. Some disturbance and the burning of much inflammable material resulted. Besides the painted buffalo, there were numerous drawings in red on the walls (fig. 46, *c*).

Artifacts, Pueblo

fragment of large bow; fragment of reed arrow
4 sherds of medium-smooth plain brown-paste

Artifacts, either Pueblo or Basket-maker

diminutive corncobs; agave-fiber quids; squash rind
yucca-fiber cordage; yucca-fiber strap; knots of yucca fiber
2 reed cigarettes; split yucca bloom stalks
small pointed sticks

Artifacts, Basket-maker

1 sandal each of the following types: Type 3, Combination Type 3+*5a*, and Type 6 (the first two are typical Hueco Basket-maker specimens, and the Type 6 example, although twilled, is a toe sandal)
hair ornaments

Cave 5, Picture Cave (figs. 1; 60, *a*). This cave, south of Buffalo Cave, consisted of 3 large, shallow pockets, profusely decorated with pictographs in red, white, and black (fig. 44, *c*). At the front were 4 milling holes in the smooth rock floor. There was no refuse.

Cave 6, Pinnacle Cave (fig. 1). This is in the base of a huge pinnacle at a higher level than Cave 5 and south of it. The opening is symmetrical and enters into a dry circular cave 30 to 35 feet in diameter (fig. 60, *b*). The place furnishes good

protection, but there was only a shallow deposit of refuse on the smooth floor to show occupancy. Rock had been piled up in a circle at the back of the cave to form a windbreak, presumably for a bed. Like Buffalo Cave, this shelter bore evidence of occasional use as a camping place. There were no pictographs.

Artifacts, Pueblo

fragment of reed arrow
narrow braid of yucca fiber
sherds of the following types: medium-smooth plain brown-paste; Chihuahua Polychrome
oblong flat-face mano

Artifacts, either Pueblo or Basket-maker

diminutive corncobs; knotted cornhusk; gourd rind
plaited bear grass
flint flakes; broken flint point
hearth or fire drill; small pointed sticks; wooden spindle

Artifacts, Basket-maker

Type 4 Hueco toe sandal

Of the 6 Playas district caves, only Cave 1 contained masonry and could be classed as a cliff ruin.

The Type 3*d*, the Combination Type 3 +5*a* fish-tail toe sandals from Cave 4, and the Type 4 toe sandal from Cave 6 are the only evidences of the presence of the southern, or Hueco, Basket-maker in these apparently Pueblo sites. The finding of characteristic northern Basket-maker articles in the mountains above Silver City, and so many Hueco Basket-maker artifacts in association with the fish-tail sandal in the Rio Grande Valley to the east, led us to expect more definite clews to a western distribution or migration than the Playas district provided. That the buffalo of the eastern plains was known to the roving tribes of the section is shown by the pictograph in Cave 4 (fig. 46, *c*, 7).

BOISE CITY, OKLAHOMA

An eastern extension of Basket-maker traits observed by us in western Oklahoma should be recorded. In 1930, William E. Baker, of Boise City, Oklahoma, sent to A. V. Kidder for inspection some specimens from a cave not previously excavated. Among these were a dart foreshaft and a fragment of an atlatl. In September of that year we visited this section and, under the guidance of Mr. Baker, who was then County Agricultural Agent, examined a number of caves. These lie in lateral canyons of the Cimarron Valley, 26 miles from Boise City, in the northwest corner of Cimarron County. The shelters are in sandstone cliffs. Two of them had been excavated by E. B. Renaud and J. B. Thoburn. From the cave excavated by Baker came the dart foreshaft, with point missing, the spur end of an atlatl, and 2 bundles of grass containing squash seeds. Other articles suggestive of the Basket-maker in the Baker collection, probably from the other caves, were fragments of fur cloth (the strips of hide twisted on themselves) and seeds strung on fiber cord.[13] This eastward extension of Basket-maker traits deserves careful consideration.

[13] Baker, 1929.

RESOURCES

THE early inhabitants who utilized shelters and caves north of Silver City and along the Rio Grande Valley lived near a sufficient supply of water to enable them to raise corn with little effort. Judging by the appearance of the country in extreme southern New Mexico and northeast of El Paso, Texas, it would seem that these people were not so favored, yet the sheet flood waters and the subirrigation of the soil from the run-off of summer rains apparently furnished enough water for all necessary crops.

In the general region, especially the northern part, there was sufficient wood for all needs. When tough, dense woods were required for weapons or agricultural implements, oak and mountain mahogany were to be found in the hills, and mesquite and thorny tornillo brush on the open flats and in the valleys. Several varieties of yucca produced fiber for basketry, sandals, and cordage. Fabrics extant show that in early periods a fine yucca fiber was used; later cotton was woven into textiles in the Upper Gila but never in the Hueco area where the only specimens of cotton found were fragments of cordage from 3 caves which contained other material of Pueblo character.

Besides the cultivated corn, beans, and squash, there were wild edible plants, fruits, nuts, seeds, and an abundance of game. The distribution of both vegetal and animal resources was fairly uniform throughout the area with but few variations due to climate and environment. This will be noted in the listing of foods available to the prehistoric inhabitants.

Neither the Basket-maker nor the Pueblo of this region could be termed experts in the working of stone; yet their skill was sufficient to meet their needs. Materials used for projectile points, axes, and other tools are recorded in the description of those articles.

FOOD

TO INDICATE the importance of different foods in the diet of both the Pueblo and Basket-maker inhabitants of the Upper Gila and Hueco areas, they are listed in the order of the quantity hidden away or the amount of waste left from preparation. In some instances this listing may be erroneous, since no doubt certain perishable items were gathered and eaten outside, and only the surplus of those suitable for storage was cached in caves and rock shelters.

Corn (fig. 65, *a–k, v*). In the Upper Gila and Hueco areas corncobs, husks, and stalks were in evidence at nearly every site investigated, and in some places in abundance.

Most of the cobs are slender, ranging from immature nubbins 1 1/2 inches long to an average length of 3 1/2 to 5 inches. It is difficult to determine satisfactorily the number of kernel rows on the cobs. However, the unavoidable element of error in count does not obscure the fact that the rows are always even in number, ranging from 6 to 14, while 80 per cent of the cobs have 8 to 14 rows. Although several varieties of corn are represented in each case, it may be of interest to compare the percentages of row-counts on cobs from the Hueco area with those from the Upper Gila. They are respectively: 8-row, 6.2 per cent (Hueco) against 25.8 per cent (Gila); 10-row, 10.4 per cent against 23.6 per cent; 12-row, 44 per cent against 19 per cent; and 14-row, 25 per cent against 9.6 per cent.

Occasionally 6-inch to 8-inch cobs, representing selected seed corn, would be stored in small grass-lined cists. Husks that have been stripped from the ear, knotted together, and additionally tied with strands of yucca leaf (fig. 65, *v*) illustrate a safer method of preserving the seed corn, by hanging it out of the reach of rodents. Some of the large ears seem to represent offerings, since the cobs often have round twigs driven into their ends (fig. 65, *b*), so that they could be set up by sticking the stem into the earth. The cob (fig. 65, *c*) wrapped with strips of husks, and with attached cord, may have a like significance.

Unfortunately most of the corn had been consumed by the people, and the rats had eaten the grain cached in pits. However, 1 perfect ear (fig. 65, *j*) and a small quantity of loose kernels scattered through the refuse at different sites (some shown in fig. 65, *k*) furnished samples of the so-called Tropical Flint variety of Basket-maker corn; also, judging from comparison with that gathered by Kidder and Guernsey, there are kernels of Pueblo flour corn in white, yellow, blue, and what seems to be red.

In the many mixed sites containing both Pueblo and Basket-maker remains the early-developed Flint corn could be easily recognized, and in Chavez and Ceremonial Caves, which were predominantly Basket-maker, this was the only variety of corn found. The small ear (fig. 65, *j*), from Chavez Cave in the Hueco area, has the popcorn bearded kernel much like that found with ancient Peruvian burials.

Agave and Yucca (fig. 65, *s*). Pulp from agave and yucca seems to have been an important food item, judging from the quantity of chewed fiber quids found in cave refuse in other southwestern districts and by ourselves in the Upper Gila and Hueco areas. The ejected quids (fig. 65, *s*), some of them showing impressions of teeth, are from 1 1/4 to nearly 3 inches long. They are composed of both the straight stiff fibers from either *Agave Parri* or *Agave Palmeri*, and a softer fiber like that of the yucca. Mescal pits, some of them under shelters, where the scorched outer leaves have not decayed, show that the agave was roasted. The acid-like burn of the juice from raw agave will quickly convince one that it should be roasted or prepared in some way before eating.

The fine-fibered quids may represent a seasonal diet derived from either the agave or yucca flowering stalks when their tender shoots, resembling huge asparagus tips, spring from the plants in July and August.

Beans (fig. 65, *l, m*). Specimens of beans from 5 sites in the Upper Gila (Doolittle Cave; Steamboat Cave; Cave 1, Middle Fork of the Gila River; Kelly Cave; and Brushy Mountain Cave) were identified as probably from the *Phaseolus* species. Not many were found and in only 1 cave had there been a quantity cached which had escaped the rodents. This was in Kelly Cave on the San Francisco, where previous to our investigations a man had uncovered a large coiled grass-bundle basket containing 92 pounds. In figure 65, *l*

is shown the black variety and in figure 65, *m* the white bean, No beans were found in the caves of the Hueco area.

Squash (figs. 65, *n;* 66, *f*, *h*). Occasional squash seeds (fig. 65, *n*) and a considerable amount of squash stems and rinds (fig. 66, *f*, *h*) were found in cave refuse of both the Upper Gila and Hueco areas. We uncovered no caches of seeds for future planting.

Mesquite Beans (fig. 65, *r*). In the lower more arid country, as in the Hueco area, beans of mesquite (*Prosopis juliflora*) were used in quantity, although very few of the whole pods made their way to the rock shelters. All over this area summer camps in mesquite growths can be located by surface potsherds, and by numbers of whole and broken metates scattered through the thickets. When the beans were ripe and beginning to dry, no doubt the early and late inhabitants made excursions to these places, and while there ground the semisweet pods into meal which does not deteriorate or lose its food value. This practice would account for the scarcity of the raw product in caves.

Tornillo or Screwbean (fig. 65, *t*). Although not found in the higher altitudes of the Upper Gila, the tornillo, or screwbean (*Prosopis pubescens*), grows profusely, with its relative, the mesquite, along the Rio Grande Valley. According to Cornell, the food value and sugar content, 25 per cent of its actual weight, of the tornillo bean is equal to that of the mesquite.[1] Therefore, there is little doubt that the seeds from this plant were ground into meal and eaten by the aborigines of the Hueco area.

Yucca Seeds (fig. 65, *u*). Although yucca seeds and pods were found in the refuse at a number of shelters, their utilization as foods is uncertain.

Grass Seeds (fig. 65, *p*). Small amounts of whole grass seeds were encountered, but like the mesquite beans they probably were converted into meal before storage. If placed in perishable containers and forgotten, remains of food in this form would soon disappear.

Nuts (fig. 65, *o*, *q*). Shells of long and round acorns, as well as piñon nuts and walnuts, appeared in caves of both areas, naturally more in the Upper Gila where the timber is heavier.

Fruits. Although the caves produced no concrete evidence of their use, cactus fruit, grapes, and berries must have been gathered.

Food Bones and Miscellaneous Bones

Cottontail rabbit (*Sylvilagus auduboni warreni*).
Jack rabbit (*Lepus californicus texanus*).
Mule deer (*Odocoileus hemionus*).
Pronghorn antelope (*Antilocapra americana*).
Ground squirrel.
Tortoise.
Large terrapin.
Porcupine (*Erethizon epixanthum*).
Badger (Berlandier's—*Taxidea americana berlandieri*).
Duck (species uncertain, about like mallard).
Fish (a good size vertebra).
Big horn sheep (*Ovis canadensis texanus*).
Bison (*Bison americanus*). One bone from Doolittle Cave.
Indian dog (*Canis familiaris*). Half of lower mandible from Ceremonial Cave
Gray fox (*Urocyon ciuereo argenteus scotti*).
Coyote (*Canis lestes*).
Wolf (*Canis rufus*).
Bobcat, lynx (*barleyi?*).
Puma or Mountain lion (*Felis concolor* subsp.).
Red tail hawk (*Buteo borealis calurus*).
Great horned owl (*Bubo virginianus* subsp.).
California condor (*Gymnogyps californianus*) Ulna unmineralized, from Ceremonial Cave.
Extinct antelope (*Capromeryx*) A genus allied to prong-horn antelope; became extinct in America in late Pleistocene times. Horn core unmineralized, from Doolittle Cave.
Extinct horse (perhaps *equus fraternus* of Pleistocene). Unmineralized phalanx, from Ceremonial Cave.
Extinct camel (*Procamelus*) One supposed to have lived into fairly modern times. Two basal phalanges, unmineralized, from Ceremonial Cave.

The preceding list of animal bones contains first those found in greatest quantity suggesting their relative value in the meat diet of the people. Next are certain species of animals, birds, or reptiles, whose remains are less abundant, probably because of rarity or difficulty of capture. Some, of course, may never have been eaten, or if so only under extreme conditions. The few remains of nearly extinct birds and prehistoric mammals are also listed but only for the scientific value of their recovery and not because it is considered that such life existed during man's occupancy of the caves investigated by us.

Judged from the bone artifacts, and quantity of

[1] Cornell, 1934b, pp. 138–39.

cracked food bones found, the cottontail and jack rabbit, deer, and antelope made up the principal meat supply. Ground squirrels and other rodents probably were used, as were the dry-land and larger tortoises, whose shells were noticeably more abundant in the Hueco caves. No doubt the porcupine and badger were eaten, as were ducks and fish; evidence of the 2 latter was found only at Chavez Cave, adjacent to the Rio Grande. Remains of big horn sheep came from Ceremonial Cave in the Hueco Mountains and from Doolittle Cave in the Upper Gila area. A single bison bone was found at the latter place. Dearth of bison bones shows that this animal probably was not native to the region, and that its meat could be procured only by special hunting trips to the plains country on the east. At the Swarts Ruin, near Doolittle Cave, a few bison bones were unearthed, but as stated in the report on that site and information gained in regard to other sites in the district, remains of this animal are practically nonexistent.[2] That the bison was known to the inhabitants of the southern area is shown by the large pictograph seen in Cave 4 (Buffalo Cave) in the Hachita Valley close to the Mexican line (fig. 46, *c*, 7). Hough mentions bison bones found at Tularosa Cave in the San Francisco drainage of the northern Upper Gila district. How these animals or their remains reached this country can only be surmised.[3] Bones of the Indian dog from the Swarts Ruin and the Basket-maker Ceremonial Cave in the Hueco Mountains prove that the animal was domesticated by both Basket-maker and Pueblo.

The remainder of the list includes such animals as the fox, coyote, wolf, lynx, panther, hawk, and owl, which may not have been used generally for meat, except in default of anything else.

In gathering the bones scattered through the refuse of different caves there was no possible way of associating those of extinct birds or animals with the food bones left by the aboriginal visitors. The unmineralized, burned ulna of a California condor from Ceremonial Cave does not prove because it was blackened by fire that this bird, which is no longer seen in a region so far east of its present habitat, was killed by man. This also applies to the unmineralized phalanx of a horse, possibly Pleistocene, and the pair of unmineralized basal phalanges of a camel found at the same place, and a horn core from a species of an antelope, which became extinct in late Pleistocene times, from Doolittle Cave in the Upper Gila area.

Mr. E. B. Sayles reports that on visiting Ceremonial Cave, subsequent to our work, he found artifacts which he considers were associated with supposedly Quaternary antelope remains (*Tetrameryx*).[4] Unfortunately our investigations simply show that prehistoric animal bones were found with human remains but not in position to prove that such animals and man were contemporaneous; however, as research continues there seems to be increasing evidence that such may have been the case. In a recent publication Howard tabulates bones of fauna discovered in Burnet Cave in the Guadalupe Mountains, within the Hueco area.[5] Among them, as at Ceremonial Cave, were remains of the extinct horse, the camel, and the California condor, and in addition, bones of an extinct bison, a "musk-ox-like animal," and a "caribou-like animal." At the Guadalupe site there seem to be indications of ancient hunting tribes of cave dwellers, who were ancestral to or predecessors of the Basket-makers buried in the upper levels. Howard demonstrated this sequence by finding a Folsom-like grooved spear-point under a large rock resting on a charcoal hearth at a level deep in the cave fill. This hearth was surrounded by the cracked and burned bones of these early animals, and at the same level and below it were other thick lenses of charcoal and ashes that seem without doubt to have been laid down by man.

It may be noted in the list of food bones that remains of the turkey are absent. In the northern Upper Gila district Hough found desiccated turkeys, both chicks and adults, as well as eggs, in Tularosa Cave where apparently the birds had been held in captivity.[6] Farther south in the area a single bone from the Swarts Ruin and a few found by Bradfield at Cameron Creek are the only instances known to us in which turkey remains have been uncovered. As noted in the report on the Swarts Ruin, it seems that for some reason turkeys were not considered fit for food, or more of their bones would have been found.[7] Absence of such bones in caves excavated by ourselves in the Upper Gila and Hueco areas agrees with the accepted theory that the Basket-makers

[2] Cosgrove, 1932, p. 4.
[3] Hough, 1914, p. 5.
[4] Sayles, 1935, p. 67.
[5] Howard, 1935, pp. 72–79.
[6] Hough, 1914, p. 5, pl. 1.
[7] Cosgrove, 1932, p. 5.

generally did not use the bird, but in the case of the later Pueblo inhabitants of the area this absence contrasts with the custom of the Pueblo farther north, where the turkey was domesticated and seemingly much prized.

Herbs (fig. 67, *a*, *b*). Bundles, coils, or branches of the common western plant *Artemisia ludoviciana* were found in the caves of both the Upper Gila and Hueco areas. Object *a* shows one of these small bundles tied with a pliable root; on others the binder is commonly yucca fiber.

The large package, *b*, consists of a neat bundle of cedar twigs partially covered with soft yucca fiber, held by a fragment of carrying net, and tied with discarded strands from feather-cloth fabric.

Whether *Artemisia*, which was found in both Basket-maker and Pueblo III sites, was used for its medicinal qualities or to procure hallucinations is not known. The significance of the bundled cedar twigs is also obscure, although its careful wrapping suggests some special meaning.

WEAPONS

Atlatls (fig. 68)

Source and Quantity. All from the Hueco area—Ceremonial Cave, 1 unbroken atlatl, 1 atlatl weight or charm, 4 proximal end fragments (one of which had finger loops attached); Chavez Cave, 1 unbroken atlatl.

Materials. Oak, mesquite, or the thorn-growth tornillo, sinew, and buckskin.

Technique. The body was scraped and sanded smooth, and notches for fingers whittled or sawed out, then rubbed smooth. A channel or spur slot was cut into the wood with a keen-edged flint tool. The proximal end was thinned and sometimes noticeably tapered. The finger notches measure 9/16 to 3/4 of an inch wide and are 3 1/2 to 3 7/8 inches from the end. There are shallow notches, above and below the finger notches for the sinew wrapping which holds the finger loops in place.

Figure 68, *b* is the only atlatl with finger loops. These are made of 2 strips of sinew, placed on either side of the shaft above the 3/4-inch broad notches, and held in shallow notches with crossed strands of sinew. The ends of the loop straps are turned up and bound in place below the broad notches in the same way. There are 2 small notches 6 inches from the proximal end on either side, and some scoring extending from them around to the back of the atlatl, seeming to indicate the former attachment of a stone or fetish of some sort at that place. The fragment has a rounded back and, starting at the finger loops on the front, a wide V-shaped trough 1/8 of an inch deep extending to the sides. The piece shows that the atlatl was but slightly curved.

Figure 68, *a*, *a'*, *a''* show the face, back, and edge of the same atlatl. This was well made. On the distal end a ridge 2 inches long is formed by the extension of the spur to the end; spur, 1/8 of an inch long, with rounded point. It has a gradually deepening, flat-bottomed, vertical-sided channel 11 3/4 inches long, tapering from 5/32 to 7/16 of an inch wide where it reaches the spur. The channel is 3/16 of an inch deep at the spur. The length of the atlatl is 24 1/4 inches; width at proximal end, 7/16 of an inch; center, 7/8 of an inch; distal end, 7/8 of an inch; thickness at proximal end, 5/16 of an inch; center, 1/2 an inch; distal end, 9/16 of an inch. The face is slightly flattened, and the back rounded. The curvature is 3/4 of an inch, perpendicular to chord at mid-point. Ten and one-half inches from the proximal end, an inch-wide whipping of sinew binds the lower end of a 4-inch buckskin covering, sewed together with fine 2-ply fiber cord and sinew threads. There is nothing to indicate that weights or charms had been attached.

On the reverse of the distal extremity of this atlatl decorative flutings (in 6 channels) extend for a distance of 5/8 of an inch. At the base and at right angles to these channels, is a light incised zigzag line.

Figure 68, *c* is a weapon showing excellent workmanship. On the back, near the proximal end, is a small knot in the wood, scored with cross hatching to prevent checking. This hatching resembles the scoring across the pin-knot checks on a dart shaft (p. 50). The distal end of the atlatl is raised to a sharp edge, terminating in a spur 3/16 of an inch long and 1 3/8 inches from the end. There is a flat-bottomed, gradually deepening, vertical-sided spur channel 4 7/8 inches long tapering from 3/16 to 5/16 of an inch wide at the spur; channel 1/8 of an inch deep at the spur. The length of the atlatl is 19 1/4 inches; width at proximal end, 1/2 an inch; center, 11/16 of an inch; distal end, 11/16 of an inch; thickness at proximal end, 3/16 of an inch; center, 9/32 of an inch; distal end, 3/8 of an inch. There are no finger notches in the sides or marks showing how finger loops were attached. The face and back are rounded, and the sides slightly flattened. The body is nearly straight, beginning to curve slightly upward at the distal end. The decoration consists of 3, incised fine, zigzag lines 1 3/4 inches long at the start of the spur channel.

Figure 68, *d*, *e*, and *f* are proximal ends of atlatls. The ends of *d* and *e* are reinforced with sinew wrappings.

Atlatl from Coyote Burial Cave, Southwestern Corner of the State of Coahuila, Mexico.[1] This spear-thrower was made of a section split from hardwood sapling. The ends were cut and rounded with a sharp stone flake,

[1] In the collection of the Peabody Museum.

and the face and back scraped with a stone tool that left scorings. The face is flat and the back rounded; the distal end is beveled on the face and back. The spur ridge, 1 1/2 inches long, stands in relief above the face. The spur slot is a shallow, scraped depression 7 inches long. At the proximal end are no wide notches or marks showing the attachment of finger loops. The dimensions are as follows: width at proximal end, 5/8 of an inch; center, 3/4 of an inch; distal end, 7/8 of an inch; thickness at proximal end, 5/16 of an inch; center, 3/8 of an inch; distal end, 9/16 of an inch; curvature of atlatl, 1/2 an inch perpendicular to chord at mid-point. The proximal end is decorated by 4 inches of red stain.

In the Upper Gila, Huecos, and Big Bend the spear-thrower is rare in comparison to fragmentary and whole darts. Hough illustrates the proximal end of an atlatl from Bear Creek Cave, in the San Francisco River section of the Upper Gila.[2] He furnishes no dimensions, but the grip and wide finger notches conform to type and give us 1 example in that district of a flat-faced spear-thrower with rounded back. Livingston speaks of finding "fragments of a dart hurler" from the Guadalupe Mountains, east of the Huecos.[3] In Burnet Cave, Three Forks Canyon, west of Carlsbad, Howard recovered the distal end and fragments of an atlatl having a wide, flat-bottomed channel and the spur end flush with the upper surface.[4] Martin reports 2 distal and 2 proximal ends of atlatls from the Shumla Cave group near the mouth of the Pecos River in Val Verde County, Texas.[5] Coffin found 4 distal ends of atlatls in south Brewster County, Texas,[6] and near there Setzler found an atlatl handle in the vicinity of the Chisos Mountains.[7] A wider distribution to the northeast, bordering the plains country, is evidenced by the spur end of an atlatl found in a cave in the Cimarron Valley, 26 miles west of Boise City, Oklahoma, by William E. Baker.[8]

The 5 specimens from Ceremonial Cave (fig. 68, *a*, *b*, *d–f*) and 1 (fig. 68, *c*) from Chavez Cave in the Hueco area have increased the number to compare with those from Nevada, Utah, and northern Arizona.

With but few exceptions, size and form are much the same in all areas. Those from the north range in length from 21 1/2 to 25 3/4 inches; the two from the Huecos are 19 1/4 and 22 3/4 inches long, while the Coahuila specimen measures 21 inches.

In the north the spur slots or channels, 1 1/4 to 5 inches, are generally shorter than in the Hueco specimens which are 4 7/8 to 11 3/4 inches, and on 1 fragment (fig. 68, *b*) the atlatl had been grooved the entire length. The Coahuila atlatl has a shallow channel 7 inches long. The short channel, however, occurs in the Big Bend, as a piece found by Coffin has a 2 3/4-inch slot.

Spurs flush on either slightly rounded or flat atlatl faces appear in all districts, as does the extension of the spur to the end, forming a ridge-roll. The same is true when the spur is continued to the end in a sharp ridge, giving a triangular form with 2 concave sides in a cross section of the distal end.

Cross sections midway in the atlatls vary in size, the thin atlatls giving flexibility and more whip when in use than the thicker and more rigid shafts. The forms are various-sized segments, some with slightly rounded face and sides, which merge into a flattened ellipse and on into the true rounded ellipse. A convex-sided triangular form also appears.

Although some atlatls are fairly straight, there is no doubt that others were intentionally bent toward the face, either by warping or by being cut into that shape.

The form of the atlatl fragment (fig. 68, *b*), with the flaring V-shaped channel starting at the finger loops, is an exception and so far as we know does not conform to those from any other district in the Southwest. The trough, which no doubt extended to the spur, lightened the weapon. One apparent advantage of this type of atlatl is that the dart could, without a glance, be placed in the trough and be quickly slid along it to engage the spur for a rapid discharge of the missile.

In the Peabody Museum is 1 complete troughed atlatl and several fragments from the Sacred Cenote at Chichen Itza, Yucatan, which have the spur extension forming a ridge-roll to the end, as do those of the Hueco and San Juan Basket-makers. None of the limited number of

[2] Hough, 1914, pl. 20, no. 2.
[3] Livingston, 1932, pp. 9–11.
[4] Howard, 1935, p. 68.
[5] Gardner and Martin, 1933, pl. I.
[6] Coffin, 1932, p. 28.
[7] Setzler, 1933, fig. 56, *d*.
[8] Personal information.

full-length and fragmentary atlatls found by ourselves and others in the Upper Gila and Hueco Big Bend have stone weights. However, it is possible that such objects were used, as suggested by the side notches shown on figure 68, *b*. An ellipitical piece of wood (fig. 68, *g*), from Ceremonial Cave, grooved at the center and painted white, resembles the typical atlatl stone or charm and, although having little weight, may have been used in that way. While excavating at the Swarts Ruin in the Mimbres Valley, 2 such stones were recovered.[9] They were probably picked up by the Pueblo in the Doolittle Cave near by, where Basket-maker artifacts have been found. Other fetishes were used, as seen in figure 68, *a*, where a 4-inch covering of leather, held by stitching and sinew wrapping, was placed midway on the atlatl. The same feature is seen in the atlatl from Nine Mile Canyon, northeastern Utah, on which a part of a deer's tail is attached to the weapon just below the spur slot.[10] Mason cites an atlatl from Grand Gulch, Utah, that is wrapped for 3 inches above the finger loops with a thick pad of "yucca fiber and cotton yarn,"[11] beneath which are beads and stone fetishes. Beyond this (seemingly well toward the spur), he states that the shaft apparently had been wrapped spirally with a strip of hide, traces of which still remain.[12] In the same collection from Grand Gulch Pepper describes an atlatl with a binding above the finger loops that holds porcupine quills.[13] The placing of fetishes beyond the finger loops, and especially the spiral winding of leather, show similarity to the leather coverings on parts of the atlatls from the Huecos, and Nine Mile Canyon in Utah.

Decoration by incising was not common, possibly because such scoring would tend to weaken the weapon. The 2 atlatls from the Hueco area (fig. 68, *a*, *c*) are incised, but not in a way to endanger their strength.

The red-stained proximal end of the atlatl from Coahuila, Mexico, is the only one among many examined that shows the use of paint.

Much of the information utilized in discussion of the differences or similarities in size, form, decoration, if any, and the attachment of fetishes to atlatls from the several areas was obtained from specimens in the Peabody Museum, most of which were gathered during the explorations of Kidder and Guernsey. For detailed description with illustrations, reference is made to the works of these authors.[14]

Darts (fig. 69)

Source and Quantity. Hueco area—Ceremonial Cave; Picture Cave; Cave 6; Chavez Cave. (For darts from the Upper Gila area, see page 54.)

The material from these sites (exclusive of many midsections of darts and unrecorded pieces) includes 1 full-length dart and 159 foreshafts, proximal and distal ends, from which 65 complete darts can be reconstructed; also 17 whole or fragmentary darts in the Alves and Smith collections in El Paso, Texas;[15] 7 more recorded by Roberts;[16] total from the area 90.

Materials. Shafts, bloom stalks of sotol (*Dasylirion Wheeleri*), a few shafts of straight growth, light semi-hardwood with pith center (hard compared to the light fibrous sotol stalks); foreshafts of heavy oak or other dense hardwood; sinew for wrapping; feathers; pigments: (black (soot or vegetable dye), red (oxide of iron); stone points (blue and gray agate, gray flint, creamy chert, white and dark rhyolite felsite).

Shafts. Sotol bloom stalks were scraped and sanded smooth, usually with all marks of the leaves removed from the stalk. They taper gradually from the distal to the proximal end. In finishing the tapering hardwood shafts, the bark was peeled, leaving a smooth surface and all knots were then worked down. An attempt was made on one of the 7 hardwood dart fragments to prevent continued splitting at the knots by scoring the wood at right angles to the small checks that had developed. One sotol shaft shows the sharp indentations of a new straightening wrench, used before the sides of the hole in the wrench had worn to a bevel.

Proximal Ends. Measurements: diameters of sotol shafts (fig. 69, *i*), 1/4 to 5/16 of an inch (majority, 5/16 of an inch; 1 diameter, 3/16 of an inch; 4 diameters, 3/8 of an inch); hardwood shafts (fig. 69, *p*), 1/4 to 3/8 of an inch; cup diameter, 3/16 of an inch; depth, 1/8 of an inch. There are 1/4-inch to 3/8-inch sinew wrappings below the cup to prevent the spur on the atlatl

[9] Cosgrove, 1932, pl. 57, *c* and *d;* p. 54.

[10] In the collection of Peabody Museum.

[11] Dr. Kidder and Mr. Guernsey, who examined this specimen, informed us that the soft yarn wrapping was apocynum fiber and not cotton.

[12] Mason, 1928, plate on p. 297; p. 306.

[13] Pepper, 1905, pp. 111–19.

[14] Kidder and Guernsey, 1919, pp. 178–81; figs. 87–88; pl. 82. Guernsey and Kidder, 1921, pp. 80–83; pl. 33. Guernsey, 1931, pp. 71–72; pl. 50.

[15] Personal information.

[16] Roberts, 1929, pl. 9.

from splitting the shaft. Some sotol and hardwood darts do not show any trace of sinew marks near the cup.

Distal Ends. Measurements: diameters of sotol shafts, as in figure 69, *q*, 7/16 to 3/4 of an inch (majority, 5/8 of an inch); no data on hardwood shafts; diameters of sockets, 5/16 to 7/16 of an inch (majority, 3/8 of an inch); depth of sockets, 3/4 to 2 1/2 inches (majority, 1 inch). The bottom of the socket hole is rounded. No pitch was used in the sockets to hold the foreshafts. In a minority of specimens the distal end is slightly tapered. The outer rim around the socket hole is rounded and smoothed. Occasionally the end is scored above the socket hole to hold sinew wrappings which prevent splitting by the foreshaft. These whippings average 5/8 of an inch in width, but they vary from 1/2 to 1 1/4 inches in width.

Size. The lengths of sotol darts, measured without foreshafts, are as follows: 1 perfect specimen (Peabody Museum collection from Ceremonial Cave), 61 3/4 inches; 8 in the Alves and Smith collections from the same cave, 53, 54, 55 1/2, 56, 60, 61, 61, and 67 inches. There are no complete hardwood shafts from this area.

Shaft Decoration. On 2 sotol shafts there are 1/4-inch wide-spaced sinew wrappings, giving a decorative effect as well as preventing splitting (fig. 69, *q*). All the painting was done before the feathers were attached. The painted decoration is as follows: 9 shafts painted black, 8 to 20 inches from the proximal end; 4 painted red at proximal end; 1 proximal end fragment, 7 inches long, striped spirally with 2 black lines 1/4 of an inch apart; 1 painted red and daubed with black beyond feathers; some painted black, 4 to 30 inches from distal ends; 1 shaft painted black from distal end to feathering; some painted red, 26 to 37 inches from distal ends; in 2 specimens, whole shaft painted red. On 1 hardwood shaft fragment (fig. 69, *p*), dark brown painting starts 1 inch beyond the feathers, and the paint, while wet, had been scraped longitudinally in irregular waved lines, exposing the light-colored wood. Many of the shafts seem never to have been decorated.

Pointed Wooden Foreshafts (fig. 69, *k–n*). These are tapered to a sharp point. Some are irregular, roughly peeled twigs, others scraped and sanded smooth. The tapered socket end is roughened. No pitch was used on the foreshafts to hold them in in the sockets. The diameters are 5/16 of an inch to 1/2 an inch (majority, 5/16 of an inch). The lengths are 4 1/2 to 10 3/4 inches. One foreshaft, 1/2 an inch in diameter and 10 3/4 inches long, has a shouldered tang, padded with fiber to make it fit tightly into the socket (fig. 69, *k*).

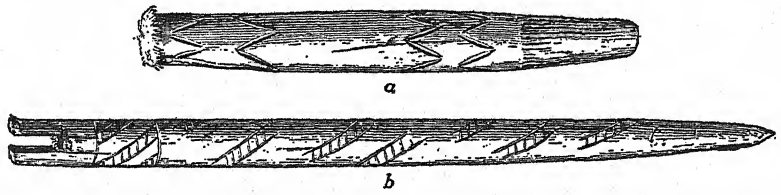


FIG. 19. Incised dart foreshafts. *a*, Steamboat Cave; *b*, Ceremonial Cave.

Stone-tipped Foreshafts (fig. 69, *a–c*). Such shafts have been sanded smooth and some have been polished. The tapered socket end is roughened. No pitch was used on the foreshafts to hold them in the socket. A nock for the stone point was formed by breaking out surplus wood (fig. 71). The sides of the nocks have been thinned, and occasionally the bottom of the nock rubbed smooth, apparently with a thin piece of sandstone. The depth of nocks varies from 3/8 to 5/8 of an inch, majority, 7/16 of an inch to 1/2 an inch. The diameters of the foreshafts are 5/16 to 3/8 of an inch (majority, 3/8 of an inch); lengths without points, 4 1/4 to 7 1/2 inches (majority, 5 to 6 inches; extremes, 2 and 9 1/2 inches); lengths with points, 2 3/4, 3 1/2, 3 5/8, 3 5/8, and 9 1/2 inches. The lengths, with points, of those in the Alves collection, 6 1/4, 6 3/8, 6 5/8, and 6 5/8 inches.

Foreshaft Decoration. One polished foreshaft, with the stone point missing, is decorated spirally with lightly incised figures consisting of 2 parallel lines connected by diagonal scorings (fig. 19, *b*). No others were decorated.

Attachment of Points. Sinew is wrapped around the end of the foreshaft and through the notches in the point. The sinew strands occasionally cross in this wrapping, and the whipping extends

below the base of the point onto the foreshaft. There is no pitch or gum in the nocks to help hold the points.

Shape of Points. The base is straight or slightly convex. There are notches either at right angles or obliquely to the long axis, forming a barb. One loose dart point is a variant of the usual form, tapering toward the base and having no notches on the sides (fig. 131, *d*).

Size of Points. The widths vary from 1/2 an inch to 1 inch; lengths, from 1 inch to 1 7/8 inches.

Dart Bunts (fig. 69, *f–h, j*). These are all from Ceremonial Cave. Bunt *j*, of oak, is roughly whittled and chopped out with a stone blade. The length is 2 3/4 inches; diameter of head, 1 1/8 inches; diameter of small end, 1/4 of an inch. The tang entered the socket for 1 inch. Bunt *f*, of oak, is roughly chopped out. The length is 2 1/4 inches; diameter of head, 1 3/8 inches; diameter at small end, 3/8 of an inch. The tang entered the socket 3/4 of an inch.[17] Bunt *g* (socket form) is made from the base of an antler. The proximal end is tapered, the distal end rounded. The diameter runs from 1 1/4 to 1 3/8 inches; length, 2 inches. The diameter of the socket is 5/8 of an inch; depth, 1 1/4 inches. The bottom of the socket is slightly pointed. Bunt *h* (socket form) is from the base of an antler. The end of the bunt is rounded. The diameter is 1 inch; length, 2 inches. The diameter of the socket is 1/2 an inch; depth, 1 1/8 inches. The bottom of the socket is rounded. Another socket-form bunt is from the base of an antler. The end of this bunt is also rounded. The diameter runs from 1 to 1 3/8 inches; length, 2 inches. The diameter of the socket is 7/16 of an inch; depth, 1 1/4 inches. The bottom of the socket is slightly pointed. There is no pitch on the bunt tangs or in the holes in the antler socket bunts.

Feathering. Three large feathers were used. The vane was not stripped from the quill, but part of the quill was usually removed. A wrapping of sinew at either end holds the feathers in place. There is no instance of plugged quills, as reported by Guernsey and Kidder and Nusbaum.[18] The length of the feathers is 7 1/2 to 8 1/2 inches. There are no perfect feathers to furnish width or to tell whether the vane had been trimmed. The distance of the feathers from the proximal end varies from 1 1/4 to 2 1/2 inches.

Darts without Foreshafts. There are 4 examples, all of sotol (fig. 69, *o*). The nocks are broken out in the same manner as in forming nocks in hardwood foreshafts (see below). The ends of the shafts are tapered and the sides of the nocks thinned. The nocks are 7/16 to 1/2 an inch deep. One specimen (fig. 69, *b*), the distal end of a dart, still holds a 1 7/8 inch stone point in the nock. The end of this shaft has been scored to hold sinew, which is missing. Figure 69, *o* has a long, smooth, flat, hardwood point with tapered end, set into the sinew-wrapped nock. The wooden point is 7 3/16 inches long; width at base, 7/16 of an inch; thickness, 3/16 of an inch. There is no pitch in the nocks to hold flat wooden or stone points in place. One of the dart fragments is painted red.

In southwestern Texas Harrington found sotol darts without foreshafts (presumably in Bee Cave, where Coffin afterward worked).[19]

Before considering the darts from the Upper Gila, 1 interesting step in the notching of dart foreshafts will be described in detail (fig. 71). Upon noting the splintered condition at the bottom of all nocks for stone points, and also that the side of the nock showed an inclination to split down the shaft, and that on either side of the shaft, at the bottom of the nock and at right angles to it, there was a scored mark, it was seen that to produce a deep notch a section of the wood had been broken out of the center of these round hardwood sticks. It was then noted that the collection contained several pieces of similar round sticks, each with a flattened tenon at 1 end (fig. 71, *h–j*), which were evidently the parts split and torn out in making such nocks. Experiment showed that this could be accomplished with nothing more than a flint knife. A stick was first notched on opposite sides, leaving in the center a bar of wood of the desired width of the nock (fig. 71, *a*). At right angles to these notches, and at the desired depth of the nock, 2 shallow nicks were made (fig. 71, *a*). After this, the stick was pinched just below the notches and bent gently back and forth, thus splitting the forward end loose (fig. 71, *b*); then, by exerting a pull and at the same time bending the stick back and

[17] In the Alves collection are 3 wooden bunts that come from the same cave.

[18] Guernsey and Kidder, 1921, pl. 34, *a, b;* p. 84. Nusbaum, 1922, fig. 17, p. 110.

[19] Harrington, 1933, p. 93.

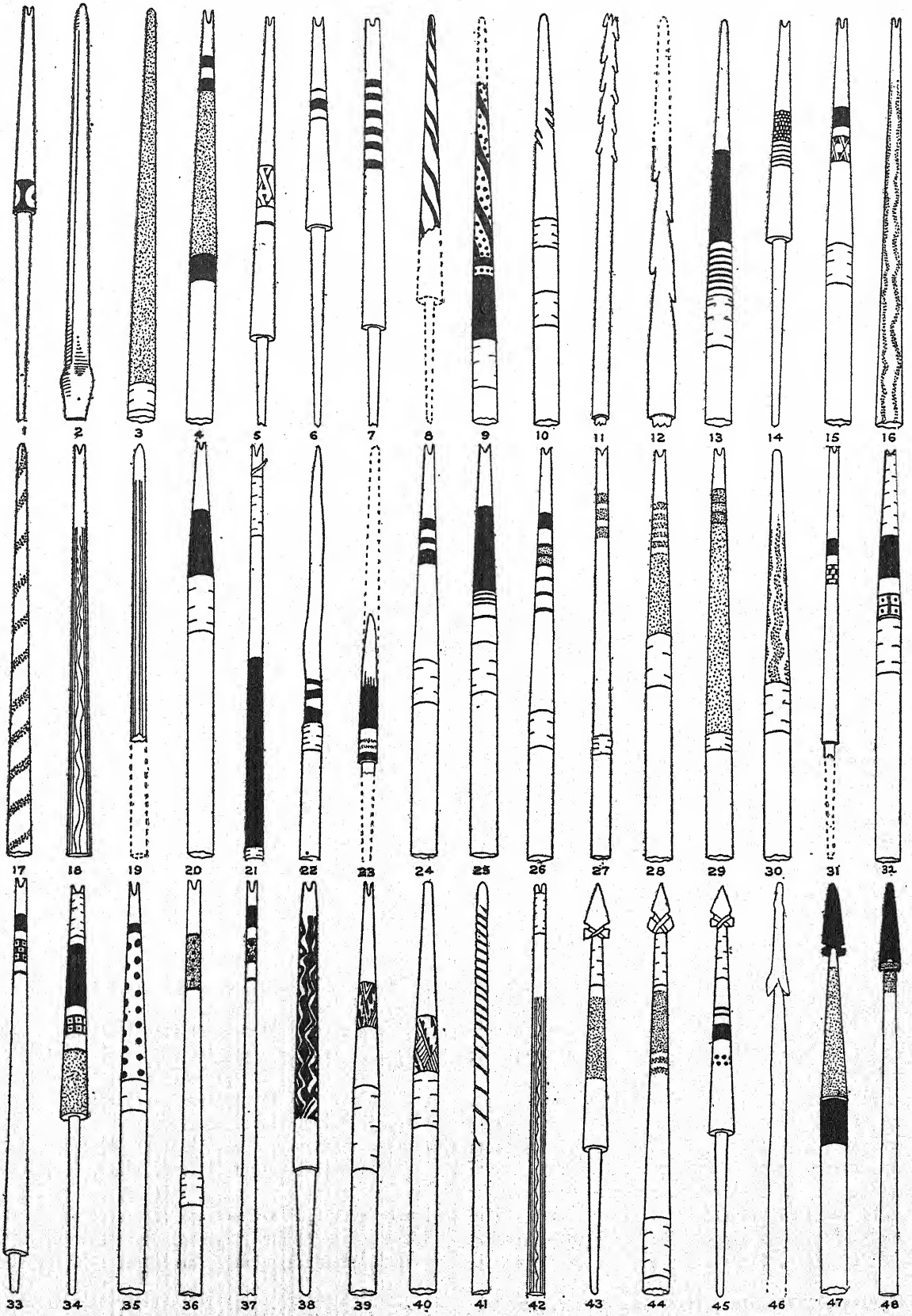


FIG. 20. Carved, incised, and painted decoration on arrow foreshafts. *11*, *12*, barbed; *14*, *33*, paint-filled, incised, waved lines under feathering; *18*, *19*, *41*, *42*, incised. Stippling denotes red.

1, Sandal Cave; *2–5*, Doolittle Cave; *6–12*, Steamboat Cave; *13–15*, Water Canyon Cave; *16–19*, Cave 1, Goat Basin; *20–47*, Mule Creek Cave; *48*, Cave 8, Hueco Mountains.

forth in opposite directions (fig. 71, *c*, *d*), the forward end was broken out, leaving in the end of the foreshaft a smooth-sided nock with frayed bottom (fig. 71, *e*). Before the stone point was inserted, a narrow whipping of sinew was sometimes placed around the foreshaft to prevent the sides of the nock from splitting down farther. Figure 71, *f* and *g* show unfinished foreshafts roughed out in this way.

It may be of interest to note that a notch for the insertion of a stone point in the end of a dart shaft from the Sacred Cenote of Chichen Itza, Yucatan, was formed in the same manner.

Darts (fig. 70)

Source and Quantity. Upper Gila area—Doolittle Cave; Steamboat Cave; Cave 1, Middle Fork; Cave 2, West Fork; Cave 1, Goat Basin; Cave 6, San Francisco; Kelly Cave—1 full-length dart and 31 fragments, from which 21 complete darts are indicated from the 7 sites in the area. (For darts from the Hueco area, see page 50.)

With Hough's 3 specimens from the San Francisco,[20] we have 25 of these projectiles from the Upper Gila.

Materials. Shafts, straight growth, light, semi-hardwood with pith center; foreshafts, heavy oak or other dense hardwood; wrappings, sinew; feathers; pigments: black (soot or vegetable dye) and red (oxide or iron); stone points (dark agate, gray flint, and gray rhyolite felsite).

Shafts. The shafts are made from slender saplings with the bark peeled and the knots smoothed. The large or distal end when reduced in diameter is very smoothly sanded. There is a gradual tapering from the distal to the proximal end.

Proximal Ends (fig. 70, *h*). The diameters generally vary from 5/16 to 3/8 of an inch, while 1 specimen is 1/4 of an inch in diameter. The diameter of the cup is 3/16 of an inch and the depth 1/8 of an inch. There is a band of sinew below the cup, usually narrow, but on 1 specimen 3/4 of an inch wide. One shows no evidence of sinew wrapping to prevent the spur on the atlatl from splitting the shaft.

Distal Ends (fig. 70, *n*). The distal ends are slightly tapered, varying in diameter from 1/2 an inch to 5/8 of an inch. The diameters of sockets are from 5/16 to 3/8 of an inch; depths, 5/8 of an inch to 1 1/4 inches. The bottom of the socket hole is rounded and contains no pitch. The ends were not scored before the application of the sinew. On the fragment shown there is a 1-inch band of sinew 1 1/4 inches from the end.

Size. The length of the 1 complete dart, without foreshaft, is 65 1/2 inches.

Shaft Decoration. One fragment was painted black beyond the feathers, and 2 shafts were painted red for the full length. Occasionally the sinew at the spur end and the sinew holding the feathers were dyed red.

Pointed Wooden Foreshafts (fig. 70, *i–l*). These are tapered to a sharp point. Some show evidence of shaving and scraping, the latter process leaving scored marks. Others are well smoothed. The socket end, which is also tapered, is roughened and shows no pitch to hold it in place. The diameters are 5/16 to 3/8 of an inch; lengths, 4 to 8 1/4 inches. None are decorated.

Stone-tipped Foreshafts (fig. 70, *i–l*). Some are scored, others well smoothed. The distal end is slightly tapered. The tapered socket end is roughend and shows no pitch.

The nock for the stone point was formed by breaking out surplus wood, to a depth of 5/16 of an inch to 1/2 an inch, as described above. The sides of the nocks were then thinned (fig. 70, *g*, *m*). The diameters of the foreshafts vary from 5/16 of an inch to 1/2 an inch (majority, 5/16 and 3/8 of an inch); lengths, without points, 3 1/2 to 5 5/8 inches (majority, 3 1/2 to 4 1/2 inches); with points, 3 1/2 to 6 1/8 inches.

Foreshaft Decoration. One is painted dark red; another red, with 2 bands of incised zigzag lines 1 1/4 inches from the proximal end and 2 similar bands 3 1/2 inches from the proximal end (fig. 19, *a*). No others were decorated.

Attachment of Points. The points are held by sinew wrappings, as described on pages 51–52, without pitch or gum.

Shape of Points. The base is nearly straight. All are notched obliquely to the long axis, forming decided barbs.

Size of Points. The widths vary from 3/4 of an inch to 1 1/8 inches; lengths, 1 5/8 to 1 3/4 inches.

Dart Bunts (fig. 70, *d–f*). The bunts shown at *d* and *e* are from Steamboat Cave, and *f* is from Cave 1, Middle Fork, Gila. Bunt *e* is of oak, roughly chipped and whittled out. The length is 2 7/8 inches; diameter of head, 1 inch; length of head, 2 inches; diameter of tang, 3/8 of an inch; length of tang, 7/8 of an inch. Head is cylindrical, and the tang slightly tapered. Bunt *d* is of oak, whittled and smoothed. The length is 3 inches;

[20] Hough, 1914, fig. 136, bunt; fig. 138, foreshaft.

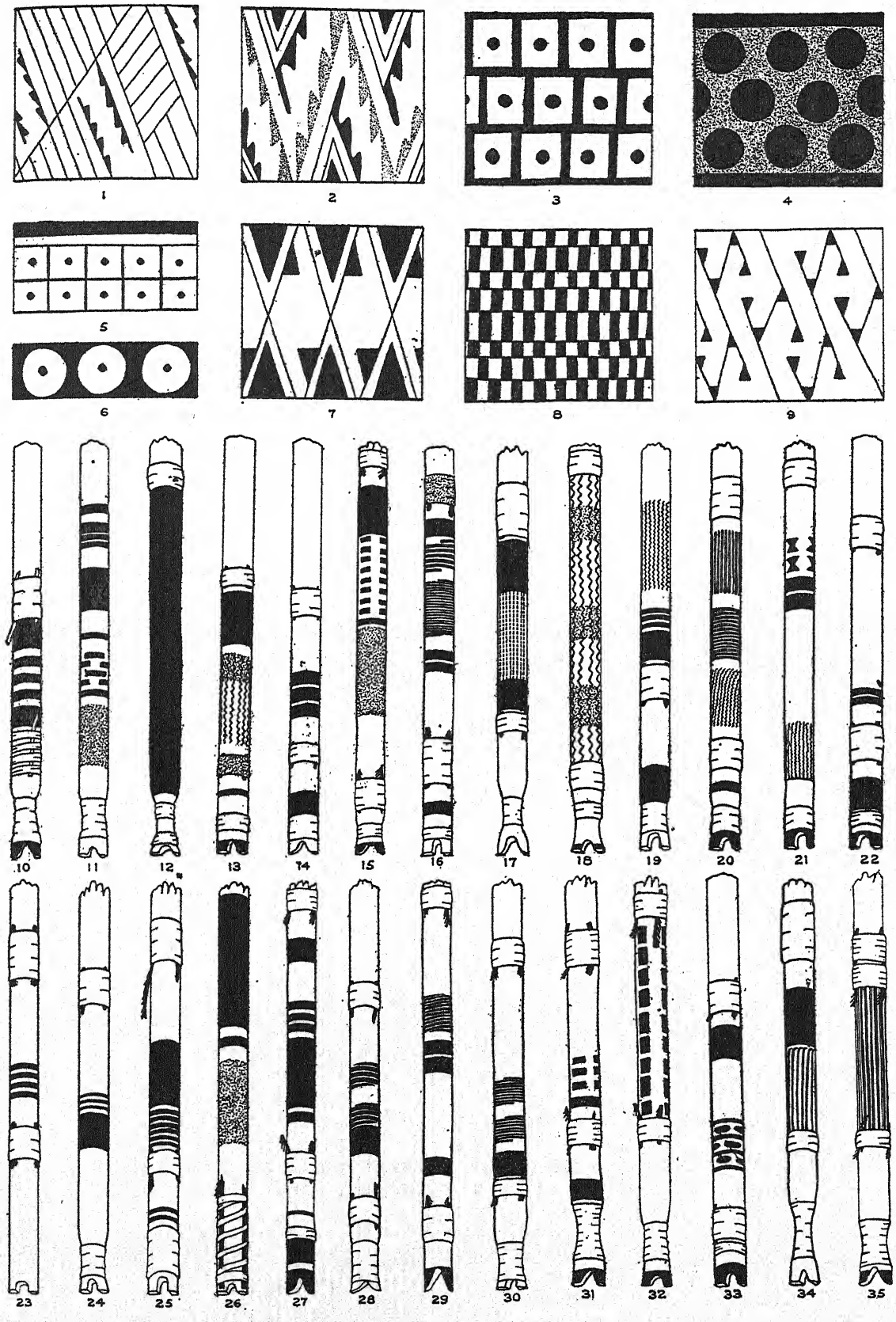


FIG. 21. Decoration on foreshafts and nock ends of reed arrows.

1–9, decorative bands on foreshafts; *10–35*, painted crests on nock ends of reed arrows (also illustrate delicate brushwork). Stippling denotes red.

1–5, Mule Creek Cave; *6*, Sandal Cave; *7*, *8*, Water Canyon Cave; *9*, *17–21*, Doolittle Cave; *10*, *11*, Cave 3, Deer Creek; *12*, Cave 9, Hueco Mountains; *13*, Ash Creek Cave; *14–16*, Lone Mountain Cave; *22–35*, Steamboat Cave.

diameter of head, 1 3/8 inches; length of head, 2 inches; diameter of tang, 5/16 of an inch; length of tang, 1 inch. The tang is scored horizontally. Bunt *f* is from the base of a small antler. The head is roughly smoothed and the tapered tang, which had been blackened by fire, shaved to form with a sharp stone flake. The length is 2 1/2 inches; diameter of head, 3/4 of an inch; length of head, 1 3/8 inches; diameter of tang, 5/16 of an inch; length of tang, 1 1/8 inches.

Feathering. Three large feathers were held in place by wrappings of sinew at the ends. The length of feathers varies from 7 to 8 inches. On 1 of the 2 dart fragments which could be measured, the feathers were 4 1/2 inches from the proximal end. On the other, figure 70, *h*, is a 1 1/2-inch band of sinew, holding the large end of the quills, 12 3/4 inches from the proximal end.

Comparison of Darts from the Hueco and Upper Gila Areas. Differences are slight and the darts from these areas are practically identical with those from Basket-maker caves of northern Arizona, southern Utah, and Nevada. In the more arid Hueco country the ever-available straight and slender sotol bloom stalks took the place of the semi-hardwood used in the Upper Gila area, to the north. One piece of sotol shaft was found by us in the Gila area and another by Kidder and Guernsey in northern Arizona. These are the only instances known to us where sotol was used outside the Hueco area. It is possible that the sotol in the north was not as sturdy, and bloom stalks of other varieties of yucca were too thick to dress down satisfactorily.

Diameters of shafts vary but slightly, those made of the harder woods being a trifle more slender. Lengths are fairly consistent; Hueco, 53–67 inches; Upper Gila (1 specimen), 65 1/2 inches; northern Arizona (Guernsey and Kidder), 52 1/2, 55, and 55 1/2 inches; 1 specimen from Nine Mile Canyon, southeastern Utah, 61 inches.[21] Diameters and lengths of foreshafts are practically the same. Bunt foreshafts were found by us in the Hueco and Upper Gila areas, the antler socket bunts from the Hueco area being well made. Hough reports a wooden bunt from Tularosa Cave, Upper Gila;[22] and Kidder and Guernsey found wooden bunts in northern Arizona.[23] Pepper describes socket-bone bunts from Utah made of deer tibiae.[24] Farther west in Nevada, in Lovelock Cave, Loud and Harrington found wooden dart bunts, both plummet-shaped and tanged-cylindrical, as well as dart foreshafts having socket-bone bunt heads;[25] and at Gypsum Cave, wooden dart bunts which almost duplicate those from the Hueco and Upper Gila areas, in that they have the same slender tang.[26] Stone points from the Upper Gila and Hueco areas are not uniform in shape, as the notches may be either oblique or at right angles to the long axis.

There are many other similarities between darts from the north and those from our southern areas. All are provided with a shallow cup at the proximal end to engage the spur of the atlatl; shafts and foreshafts were worked into shape in the same way, and evidently with the same types of stone tools; nocks for stone points in foreshafts were always formed by breaking out the wood as described on pages 52, 54, and, among the many specimens examined, no pitch or gum was ever used to hold the stone point in place or to cement the foreshaft into its socket. The use of pitch to fasten stone tips to dart foreshafts is recorded by George C. Martin at the Shumla group of caves on the Rio Grande, near the mouth of the Pecos.[27] This departure from the Hueco and northern Basket-maker practice may prove to be a merely local variant. None of the foreshafts found by Howard in the Guadalupe Mountains of New Mexico, or by Coffin at Bee Cave in Brewster County, Texas, has pitch on either end.

In fletching shafts, feathers of almost equal lengths were used, and the 3 feathers were always attached to the shaft with a whipping of sinew at either end.

Decoration of darts in all areas was somewhat limited, consisting mainly of painting the whole shaft or parts of it. No elaborate designs were attempted, such as were developed later when arrows came into use.

At Gypsum Cave Harrington found darts with decoration comparable to that on arrows. He considers them earlier than the darts from other sites which show better workmanship, but less ornamentation.[28]

[21] Collected for the Peabody Museum by Donald Scott, Claflin-Emerson Expedition.

[22] Hough, 1914, fig. 136; p. 60.

[23] Kidder and Guernsey, 1919, pl. 84, no. 9; fig. 92, p. 185. Guernsey and Kidder, 1921, pl. 34, *e;* p. 86.

[24] Pepper, 1905, p. 126.

[25] Loud and Harrington, 1931, pl. 46.

[26] Harrington, 1933, fig. 16.

[27] Martin, 1933b, pl. IX; p. 27.

[28] Harrington, 1933, frontispiece; p. 114.

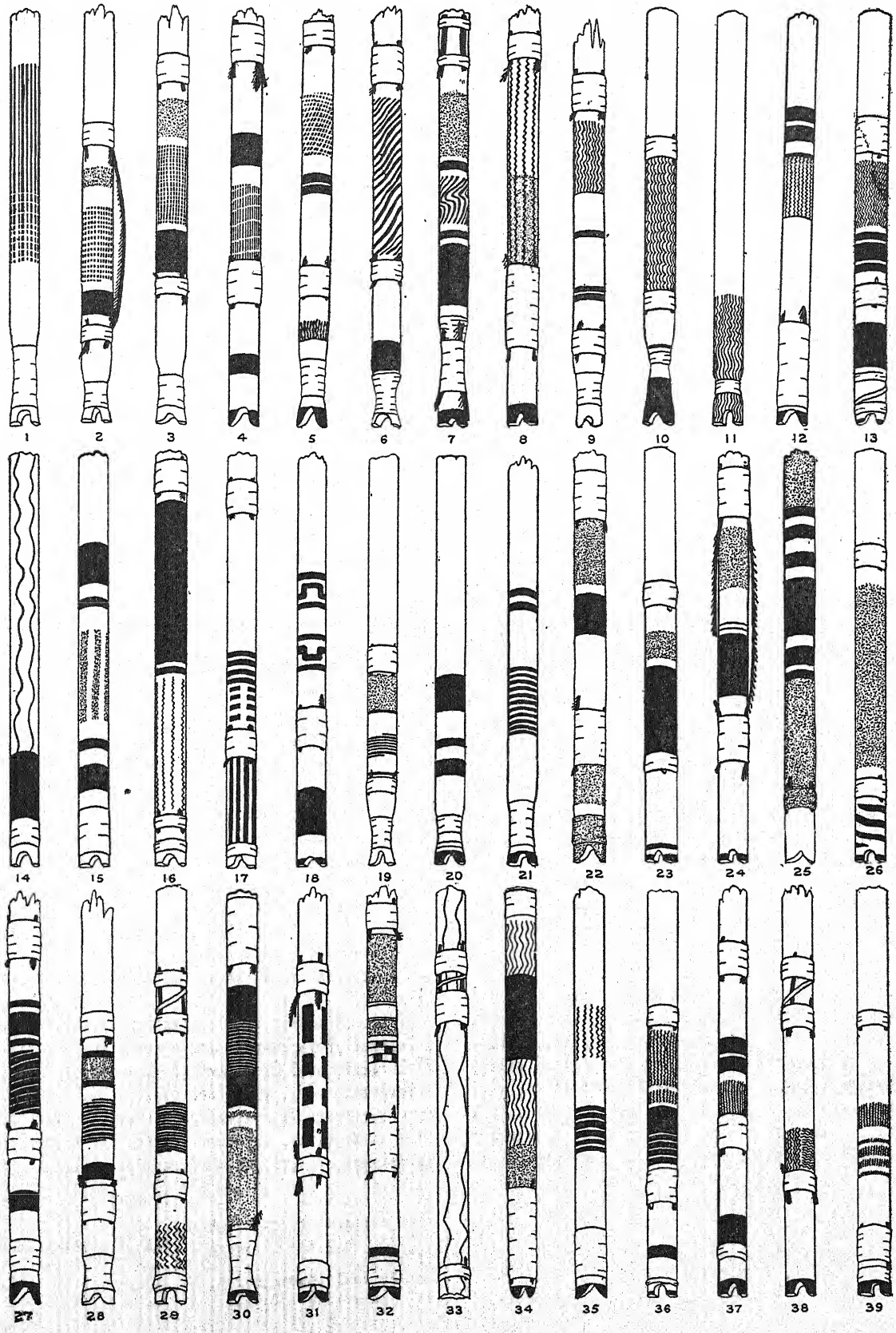


FIG. 22. Fine brushwork on painted crests of reed arrows.

1–4 examples of combing the wet pigment; *14*, *33*, only examples of incising reed shafts; *30*, a preliminary whipping of a fine thread or hair before black paint was applied leaves a fine white spiral when removed. Stippling denotes red. *1–13*, Steamboat Cave; *14–18*, Cave 1, Goat Basin; *19*, Cave 6, San Francisco River; *20–39*, Mule Creek Cave.

From the foregoing it is seen that the differences in size and technique are negligible, and that the darts made in Utah and northern Arizona are in all major respects the same as those from the Upper Gila of New Mexico and from the Huecos of Texas.

East of the Huecos Howard found dart foreshafts in the Guadalupe Mountains.[29] Smith reports a fragmentary dart and stone-tipped foreshaft from the Big Bend;[30] Coffin recovered foreshafts and pieces of sotol bloom stalk darts in Brewster County, Texas, the extreme southern part of this region.[31] In the Big Bend Setzler found a dart foreshaft and a bunt point in the Chisos Mountains;[32] Harrington, pieces of darts at Sandal Cave up the Rio Grande Valley near San Marcial;[33] and Hough, a foreshaft with a stonepoint from a guano cave near Lava, New Mexico, 17 miles south of San Marcial.[34] Parsons found foreshafts and fragments of darts in a shrine near Laguna, New Mexico,[35] and Alexander and Reiter recovered notched and pointed wooden dart foreshafts at Jemez Cave, north of Albuquerque.[36] Considerably farther east a dart foreshaft with stone point missing was found by William E. Baker, just over the New Mexico line west of Boise City, Oklahoma.[37]

Grooved Fending Sticks (fig. 72, *a–h*)

Source and Quantity. Upper Gila area—Doolittle Cave, 1 fragment; Cave 6, San Francisco, 2 fragments. Hueco area—Chavez Cave, 1 fragment of heavy stick; Ceremonial Cave, 2, complete, 31 fragments, also 3 complete miniature sticks and 1 fragment. (Fourteen complete and 7 fragments of heavy sticks from Ceremonial Cave in the Alves-Smith collections, El Paso, Texas.)[38]

Materials. Oak; leather; and sinew for wrapping; pitch to cover the grips and to hold the leather in place.

Technique. The wood was sectioned and shaved or scraped with a sharp-edged tool, then sanded or rubbed smooth with an abrasive. A whipping of sinew has sometimes been placed where the wood had split in drying. The proximal end commonly is reduced in size for a distance of 3 to 4 inches, and this hand-hold, or grip, roughly scored with transverse lines. On 2 specimens (one of them fig. 72, *c*), there is a deep notch cut in the convex edge 1 3/4 inches from the end. All grips, whether scored or not, are daubed with pitch. From markings on the grip ends, and on one having particles of buckskin still adhering to it, it seems that a leather bumper was fastened at one time to the edge and held from slipping by the deep notch; or if there was no notch (fig. 72, *a*), it was held by the pitch, a coating of which can still be seen adhering to parts of the grip that were not wrapped. On 1 fragment (fig. 72, *h*) and on a specimen in the Alves collection, a shallow inch-wide depression extends around the sides and edges of the hand-hold. This channel may very well have been sufficient to prevent the stick from slipping out of the hand, or may have been intended to seat wrappings of leather or sinew to form a bumper.

Shape and Size. Both ends are usually rounded. On 3 fragments the edges on distal ends have been cut away, narrowing the end, as on the fragment, figure 72, *b* and miniature stick *g*. The edges have been left rounded or slightly flattened. The majority of these sticks are not much curved, and some are nearly straight. There are, however, a few exceptional fragments showing greater curvature, 1 piece (*d*) having a decided increase in width at the distal end. The lengths (obtained by including those in the Alves-Smith collections) vary from 22 1/2 inches to 38 inches; average length, 32 inches; widths, 1 to 1 3/8 inches; thickness, 1/2 an inch to 5/8 of an inch.

The fragments from the Upper Gila are too small to indicate size or shape.

Decoration. Characteristic decoration consists of 4 deeply scored parallel lines on both sides of the stick, forming a ribbon 5/16 to 3/8 of an inch wide, starting at the grip and extending to the distal end.

In the collection are a few exceptions in which 3 instead of 4 channels are scored on the sides. This occurs on 3 fragments of large sticks and on 1 fragment and 2 complete miniatures. Clearly, it was always the intention to make the incised lines continuous, but hard knots in the timber occasionally interfered, causing the ribbon to be

[29] Howard, 1930, pl. XXX, no. 5.
[30] Smith, 1932, pl. 12, no. 26.
[31] Coffin, 1932, p. 31.
[32] Setzler, 1933, fig. 56, *b*, *c*.
[33] Harrington, 1928a, pp. 5–10.
[34] Hough, 1914, p. 19.
[35] Parsons, 1918, pp. 381–405.
[36] Alexander and Reiter, 1935, pl. XIII, *i* and *e*; figs. 11 and 15.
[37] Personal information.
[38] Personal information.

broken into panels. The few fragments from the Upper Gila have the typical 4-line incising.

Bands of sinew may have been considered a decoration, as they are never evenly spaced along the stick, but their primary use was evidently to prevent the wood from splitting. The bands either overlap the incised grooves or the grooves were obliterated before the sinew was applied.

There seem to be a greater number of sinew bands, either for decoration or for strengthening, on the fending sticks from the southern area than on those from farther north, possibly because the former are generally much longer and require extra reinforcement. However, sticks from other districts are wrapped at one or more places, as shown by specimens found by Guernsey and Kidder,[39] and by Judd in northern Arizona.[40]

Notches to hold bumpers, or evidence of bumpers on sticks without the notch, always show that the bumper, either of leather or fiber, was on the convex edge. This is true of a fragment from the Big Bend region shown by Smith.[41] The position is also the same on those from northern Arizona shown by Judd, and indicated by the cup in which to seat a bumper on the edge of sticks from White Dog Cave, illustrated by Guernsey and Kidder.[42] Wide and narrow grooves for attachment of the bumper are also seen on sticks found in a shrine near Laguna by Parsons.[43]

Regardless of its use, the bumper was an adjunct to the fending sticks, both in the northern and southern areas. A knob on the end of a grooved fending stick from Lava, New Mexico,[44] and another illustrated by Livingston from the Guadalupe country east of the Huecos[45] are similar to a feature that is also seen on the flattened throwing stick of the modern Pueblo.

As mentioned, a fragment (fig. 72, *d*) from the Huecos is strongly curved and has a broad distal end, as do those figured by Guernsey and Kidder, which are 1 3/4 to 2 inches wide, tapering to 1 1/4 inches at the handle. These sticks are 20 1/2 and 21 1/4 inches long, considerably under the average of 32 inches for those from the Huecos. Judd's specimens from northwestern Arizona appear to be longer, possibly 25 to 27 inches.

In the Huecos the breaking of the series of scored lines into panels appears to have been caused by imperfections in the wood, but it often results in a more decorative effect than is produced by continuous lines. The line break on the northern Arizona specimens, however, seems to be purely decorative. Irregularly spaced wrappings of sinew we consider primarily utilitarian. There is no painting on the Upper Gila-Hueco sticks, nor on specimens found farther north or south.

The distribution of fending sticks in the Southwest follows. To the northwest of the Upper Gila-Hueco areas one was found by Harrington in southern Nevada;[46] others by Judd and by Guernsey and Kidder in northern Arizona. To the northeast, at Jemez Cave, north of Albuquerque, Alexander and Reiter recovered a specimen,[47] and Parsons found others in a shrine near Laguna, N. M. Farther south Hough reports 1 from Lava, east of the Rio Grande below San Marcial. East of the Huecos Howard collected 2 fragments at Shattuck Cave, 15 miles west of Carlsbad.[48] One had 4 interrupted, the other 3 continuous, incised lines. He also found another piece in Dark Canyon in the same area. Livingston also illustrates 1 from the Guadalupe Mountains.[49] At the mouth of the Pecos River Pearce and Jackson found complete and fragmentary specimens in Seminole Canyon to the east of the Pecos,[50] and Martin got fragments at the Shumla Cave group to the west.[51] From farther south in the general Big Bend region Smith shows parts of 4 specimens, and, in southern Brewster County Coffin secured fragments of sticks,[52] as did Setzler in the Chisos Mountains.[53]

That these objects were actually fending sticks to deflect darts is more than probable, since in the Southwest they are always associated with the Basket-maker atlatl and darts. The longer ones might be effective as clubs at close quarters, but apparently they were never used for throwing,

[39] Guernsey and Kidder, 1921, pl. 36, *f* and *g*; p. 88.
[40] Judd, 1926, pl. 51, *c* and *d*; p. 147.
[41] Smith, 1932, pl. 12, no. 27.
[42] Guernsey and Kidder, 1921, pl. 36.
[43] Parsons, 1918, fig. 39, pl. 385.
[44] Hough, 1914, fig. 21, p. 19.
[45] Livingston, 1932, pp. 9–11.
[46] Harrington, 1926, p. 232.
[47] Alexander and Reiter, 1935, pl. XIII, *h*; fig. 10.
[48] Information by courtesy of the Museum of the University of Pennsylvania.
[49] Livingston, 1932, pp. 9–11.
[50] Pearce and Jackson, 1933, pl. IX, p. 44.
[51] Martin, 1933b, pl. XXX.
[52] Coffin, 1932, p. 28.
[53] Setzler, 1933, fig. 56, *a*.

since none of them are badly chipped on the edge, as they would have been if thrown at small game through rocks and brush. Rocks fallen from the cave roof are responsible for breaking and bruising some of the specimens.

Parallel incised lines, although in greater number, are seen on fending sticks from the Sacred Cenote at Chichen Itza, Yucatan, and identical sticks, together with the atlatl and darts, are often depicted in the late Mayan frescoes and sculpture.

Round Sinew-wrapped Fending Sticks (fig. 73, *d–i*)

Source and Quantity. Hueco area—Chavez Cave cache of 6 sticks.

Materials. Mesquite wood; sinew and buckskin.

Technique. Unpeeled sections were cut from the limb with a sharp stone flake, and the ends then rounded and rubbed smooth. Five sticks are completely covered with wrappings of sinew strands, while one (fig. 73, *h*) bears no sinew wrapping except a 3/8-inch band near the rounded end, the opposite end having never been dressed down. There is also a wrapping of narrow strips of buckskin, forming a knob, or bumper, 3/4 of an inch to 1 inch from the handle end of each sinew-wrapped stick. These knobs stand 1/4 to 3/8 of an inch high, and the buckskin forms a band 3/4 of an inch to 1 inch wide. The bumper is made by knotting the leather strips and concealing the ends in a manner that cannot be determined, and contains no padding. It is always on the convex side.

Shape and Size. The sticks are slightly curved. The lengths of the wrapped clubs are 20 1/2, 22 3/4, 24 3/4, 28 1/2, and 30 3/4 inches, unwrapped club (fig. 73, *h*), 25 1/2 inches; average diameter, 3/4 of an inch.

Many, if not all, of the Basket-maker grooved fending sticks just described had attached bumpers always on the convex edge. The same feature appears in the round sinew-wrapped fending sticks. That these are also of Basket-maker manufacture is certain, because they have bumpers in a similar position, and because they were found with a Basket-maker coiled-netted bag and a colored twined-woven bag in a cave also containing an atlatl and pieces of darts.

Flattened Throwing Sticks (fig. 72, *i, j*)

Source and Quantity. Upper Gila Area—Doolittle Cave, 2 fragments and 1 complete stick.

Material. Oak.

Technique. A distal end fragment, whose extreme end is slightly thinned, and a proximal end fragment have slightly rounded sides and flattened edges. A knob has been cut on the end of the latter specimen (fig. 72, *i*). On the complete stick (*j*) the hand-grip is roughened on the sides for 4 inches, while the rest of the stick is well smoothed, and edges and ends rounded. The length of the stick is 20 3/4 inches; width, proximal end, 1 inch; center, 1 1/8 inches; distal end, 1 5/16 inches; thickness, proximal end, 1/2 an inch; center, 5/8 of an inch; distal end, 3/8 of an inch; curvature, 1 1/8 inches (chord to arc at mid-point).

In the complete stick, and in the fragment of another, thinning of the distal end is in noticeable contrast with the Basket-maker grooved fending sticks. The advantages of this feature can only be surmised, but at least it gives the weapon, which is thought to be Puebloan, better lines, and if used as a throwing stick, it would travel with less air resistance.

The handle (fig. 72, *i*) with flattened edge and knob on end, is somewhat like that on the grooved fending stick from the Guadalupe Mountains, shown by Livingston.[54] The specimen is partially decayed, and if at one time there were incised lines on the sides, they have now disappeared.

Although the flattened and the heavier round sticks might be classed as weapons of war, yet the flattened throwing stick, especially, seems to have evolved from the grooved fending stick and later to have become a hunting implement. With the exception of the set of sinew-wrapped fending sticks above, there is nothing characteristic in the great number of light or heavy sticks of this nature from the caves to show that they belong to any one period.

Round Throwing Sticks (fig. 73, *a–c*)

Source and Quantity. Numerous in the caves of the Upper Gila and Hueco areas.

Materials. Oak, mesquite, ocatillo, or other tough woods.

[54] Livingston, 1932, pp. 9–11.

Technique. Unpeeled branches were sectioned with a sharp stone flake and broken off. The ends are sometimes smoothed, and the small end of the club occasionally scored spirally or transversely for a hand-hold (fig. 73, *b*).

Size and Shape. The length varies from 19 to 24 inches; diameter, 1/2 an inch to 1 inch; some are moderately straight, others crooked.

Decoration. One stick (fig. 73, *c*) was roughly scored spirally for its entire length.

The quantity of sticks found throughout these districts which had been visited by the Pueblo and Basket-maker no doubt shows a general use of this crude weapon by both people for killing small game.

Bows

Source and Quantity. All from the Upper Gila area—Doolittle Cave, fragments of 10; Lone Mountain Cave, 1 complete; Greenwood Cave, 1 complete and 5 fragments; Steamboat Cave, 7 fragments; Mule Creek Cave, 2 complete and 7 fragments; Cave 1, Goat Basin, 6 fragments; Saddle Mountain Cliff Ruin, parts of 6 bows—total, 4 complete and 41 fragments.

Materials. Predominantly medium-heavy, fine-grained wood with brown heartwood; 1 bow apparently of dense mountain mahogany; another of tough thornwood, mesquite, or tornillo; use of fine-grained cedar or juniper shown by several fragments.

Technique. Skill has been shown in carefully following the grain of the wood and not cutting through knots, which would weaken the bow at those points. Some tips are without notches, but in others are shallow irregular notches at one or both ends. The tip of 1 fragment has been wrapped with sinew to keep the string from sliding down the arm.

Shape and Size. There are 3 types: Type 1, round in cross section through the entire length; Type 2, with flat back and round belly through entire length; Type 3, with one-third to one-half of the length left round at the center, both limbs with flattened back. On the back of 1 complete Type 2 bow and a fragment of another, there remains 1/4 of an inch of light sapwood. Measurements: diameter at center, round grip of Type 1 bows, 3/4 to 1 inch; Type 2 bows with D-shaped grip, 7/8-in to 1 1/8-inch diameter side to side, and 7/8-inch to 1 1/4-inch diameter belly to back; round grip of Type 3 bows, 3/4-inch to 1 1/2-inch diameter; length of 1 complete Type 1 bow, 54 1/2 inches; length of 2 complete Type 2 bows, 37 and 45 inches; lengths approximated from long fragments of 2 Type 2 bows, 45 and 48 inches; lengths approximated from long fragments of 2 Type 3 bows, 49 and 56 inches. A variation of Type 2 is thin at the center, being 1/2 an inch thick and 1 inch from side to side. The length of this bow is 36 inches.

Decoration. One fragment of a grip is wrapped with sinew bands, and there are marks on 2 other pieces showing that the bows had been wrapped spirally with sinew and painted entirely black. One of the latter has 4 sinew bands near the tip, between which the spaces are painted red, black, and green. The bows without wrappings are painted all over red, black, and green. One limb fragment is solid green with an uncolored space 5 inches from the tip encircled by 4 1/4-inch stripes in red. The tip of another is black for 8 inches, below which is a 2 3/4-inch band of red, and from this to the end of the fragment are 3/16-inch black bands, 3/4 of an inch apart. The center of another bow is solid red, and 20 inches of the limb, starting at the tip, are painted spirally with a 1/2-inch red stripe. On 1 complete bow the smoothed bark was left on the back of both limbs. A 5-inch space at the center was scraped clean and this grip was painted red; from there outward the limbs were given a coat of green over both bark-covered back and light-colored belly. Apparently sinew wrappings were used for decorative effect as well as to prevent the wood from splitting.

Bowstrings and Attachment. To 1 bow tip there is still attached a 3-strand yucca-fiber bowstring, 3/16 of an inch in diameter, and tapered at the end. Where it is tied to the bow the tapered end is enlarged and reinforced by a ribbon whipping of untwisted yucca fiber. The string was made fast by giving its end 6 turns around the tip and securing it with a half hitch. This appears to be a permanent attachment. There are no means of determining how the string was fastened at the other end. However, because no finished loops in suitable cordage were found in the caves producing bows, and also because the fragmentary and complete bows generally have shallow end notches or none at all, it seems that the method of bracing the bow by sliding a looped string up to a notch was never practised and that, much to its detriment, the weapon was left permanently strung.

From a technical standpoint the bow never reached a high degree of perfection. In all of

these not made of clear stock the grain was followed over knots to prevent weakening. Two bows were backed with the sapwood, which was unusual, yet it shows there was knowledge of the toughness of this outer layer, which would prevent the resilient heartwood from breaking when bent. Then too, the flattening of the back through its entire length, as in Type 2, and the same process on the limbs of Type 3, indicates recognition of the fact that this prevents the bow from twisting in the hand when sprung and forces it to follow the string. Type 1 bows, round in cross section throughout, do not have this quality. Five Type 1, 7 Type 2, and 29 Type 3 bows were found, proving that the weapon with round body and flattened limb was most used.

A serious defect in the foregoing, and one that seems to be prevalent in most primitive bows, was the failure to stiffen them for a certain distance at the center by leaving additional wood at that point and thus prevent a recoil, or kick, when the arrow was released. The bows probably had no great cast, yet some of them with 1 1/8-inch to 1 1/2-inch diameter at the center, and the one requiring a 3/16-inch string must have pulled nearly 40 pounds and would have been effective at close range.

The bows of this area are generally crude. This is peculiar, in view of the careful workmanship bestowed on the quickly lost arrows of the same people.

At a number of sites, several of them undoubtedly shrines, decorated and plain bows had been deposited as offerings. At Mule Creek Cave, a long-used shrine, bows were particularly abundant. Aside from the 9 specimens brought in, 28 fragments of large bows were left in the cave (fig. 74, *b*). Since the place had been dug over numbers of times by curio-seekers, many more whole and fragmentary bows must have been taken away.

The large bow only occurred in the northern districts of the Upper Gila area. A few pieces of reed arrows were found in the Hueco area, but strangely enough not a sign of a bow was seen in the caves in that part of the country. This may be explained by the fact that these caves were apparently never occupied as homes by the Pueblo, serving only as temporary shelters for parties in transit.

Ceremonial Bows. Miniature replicas of bows are described under Ceremonial Bows (see pp. 130–32).

Arrows (figs. 20–22, 75, 76)

Source and Quantity. Upper Gila area, 19 perfect arrows, 22 reed shafts with broken foreshafts, and 1691 fragments. Hueco area, 157 fragments.

Materials. Shafts of reeds; foreshafts of hardwood; sinew for wrappings; feathers; pitch or mesquite gum for glue; vegetal and mineral substances for paint in decoration; points of obsidian.

Shafts. The shafts show no evidence of having been smoothed, as in this variety of reed the joints are not prominent and cause little air resistance. The butt end of the reed is always at the distal end of the arrow. The shafts measure 1/4 to 3/8 of an inch in diameter; of 22 specimens, extremes in length are 20 1/4 and 28 1/4 inches (majority, 24 3/4 or 27 inches). At the proximal end the reed is severed below a joint and commonly filled with a wooden plug (fig. 75, *f*, *h*), or occasionally with splinters of reed to prevent splitting by the bowstring (*g*). A few nocks were cut in the reed above a joint so that no plug was necessary. The length of the wooden plug is 3/4 of an inch to 5 inches (majority, 1 1/2 to 3 1/2 inches); length of splint plug, 3/4 of an inch to 3 1/2 inches. In most cases no pitch was applied to these plugs, and they are held in place by a tight wrapping of sinew directly below the nock, which often constricts the shaft at that place if it is not entirely filled by the plug (*s*). The nocks are nicely filed in, presumably with a thin abrasive stone, the cuts usually being U-shaped or wide V-shaped notches slightly rounded at the bottom; depth, 3/32 to 6/32 of an inch; width at top, 3/32 to 6/32 of an inch. The shaft is squarely severed and smoothed where it engages the foreshafts. Compressing the reed below the nock gave additional purchase for the fingers, and although the majority of the arrows do not possess this feature, it shows that in pulling the bow, the arrow was grasped by the thumb and forefinger. The shape and the shallowness of the nock also indicate that the arrow probably was held against the string in this manner.

Foreshafts. To seat the foreshaft in the reed, the end is dressed in 3 ways: first, with a straight tapered tang (fig. 75, *a*); second, with a slightly concave tapered tang (*b*); and third, with a straight tapered tang and with a shoulder which fits against the end of the reed (*c*). In the first and second types the reed end may not be beveled, but it is usually sanded down to a thin edge. About the end of the reed, a tight wrapping of sinew,

which never laps onto the foreshaft, leaves a slight bulge at the junction on the first type, and, on the second, constricts the reed so that the diameter of the shaft is not enlarged. With the shoulder-tanged foreshaft, the reed is made to abut the shoulder perfectly, and the junction of the reed and foreshaft is sanded down. The wrapping of thin sinew around the reed does not materially increase the thickness of this perfect joint. All foreshafts are cemented into the reeds with pitch. They are smoothed and rounded by sanding, sometimes even polished, and taper gradually to the forward end, which may be left sharp, or, for the attachment of a stone point, a small notch may be cut in the end, much like the string nock but with thin sides, or lips. Sometimes narrow bands of sinew have been placed at intervals along the pointed foreshaft or near the tip to prevent its splitting when striking a hard object. Broken foreshafts were often resharpened. Some of the tangs have been driven back through the septum of the reed shaft. The diameter of the foreshaft at its junction with the reed measures 1/4 to 5/16 of an inch. The length of those from the Upper Gila varies from 2 1/2 to 9 3/4 inches (majority, 3 1/2 to 6 1/4 inches; a few unusual lengths, 10 to 15 1/2 inches). The tangs are 3/4 of an inch to 4 1/2 inches long (majority, 2 to 3 inches).

The foreshafts from the Hueco area measure 6 1/2 to 9 inches long (unusual lengths, 10 to 12 1/2 inches). The tangs are 1 to 3 inches long. All but one of the 94 from that area had tapered tangs, while in the Upper Gila 60 per cent were shoulder tanged.

Unusual Arrow Foreshafts. Two are well polished and have decided barbs cut on their sides (figs. 20, nos. *11*, *12;* 76, *o*, *q*). Six foreshafts in the collection are square in cross section (figs. 20, nos *2;* 76, *1*). Four have imitation stone points carved on the end (figs. 20, nos. *46–48;* 76, *p*, *r*, *s*). Two of these are like figure 76, *p*, with the carving so delicate that the point, which is painted black, appears to be seated in a notch in the end of the foreshaft. Marks on the specimen show that to carry out the illusion, sinew had been wrapped around the foreshaft and point, as was the case in a similar foreshaft (fig. 76, *s*) which still has the sinew around it, giving the impression of holding a black obsidian point in place. Another arrow foreshaft of this same type, not so well executed, is shown in figure 76, *r*.

Attachment of Stone Point. All points are of obsidian, are held in the notched end of the foreshaft with a touch of pitch, and bound in place with a narrow ribbon of sinew. The sinew engages the notches on the point with a figure-eight wrapping, after which it is wound smoothly for 3/4 of an inch to 1 inch down the foreshaft, the whole being held by the natural glue in the sinew (fig. 130.)

Arrow Bunts. From Ceremonial Cave in the Hueco Mountains are 2 arrow bunts, one still inserted in the reed shaft (fig. 76, *a*, *b*). They are of hardwood, with the knobs 1 inch long and, respectively, 5/8 and 3/4 of an inch in diameter. The tangs are 1 3/4 and 2 1/4 inches long. The bunt is held in place by a band of sinew wrapped around the end of the reed shaft. A crude type of bunt from Cave 1, Middle Fork of the Gila, was made by forcing over the foreshaft a tubular section of alder (fig. 76, *c*). Kidder and Guernsey illustrate a hollow bone arrow bunt from northern Arizona.[55]

Feathering (fig. 75). Three feathers were always used and were spaced around the shaft with a fair degree of accuracy. The vane of the feather was not stripped from the quill, but instead was held in better alignment by being left attached to part of the quill, which was neatly split apart. Part of the vane was pulled from the quill at the end of the feather. These quills were bound to the shaft with sinew wrappings, which sometimes continued to cover the shaft as far back as the arrow nock. Small feathers required no trimming, but when those from large birds were used, the vane was apparently trimmed to a uniform width of from 5/8 to 3/4 of an inch. Extremes in feather lengths are 1 and 5 inches (majority, 1 1/4 to 3 inches long). The feathers are usually set 1/2 an inch to 1 1/2 inches from the nock, others as far as 2 1/4 inches down the shaft. Identification of the feathers is uncertain, but some of them appear to be from the mourning dove, flicker, and a large hawk. Of the heavier feathers none seem to be of the turkey, and it is doubtful if they were used, since no turkey bones were found. Hough found remains of turkeys in the Tularosa Cave in the San Francisco drainage but does not state that feathers of this bird were used on the arrows he recovered.[56]

[55] Kidder and Guernsey, 1919, fig. 47, *a*, p. 122.

[56] Hough, 1914, pl. 1; p. 5.

Size. Of 19 arrows, complete with foreshaft, the extremes in length are 29 1/8 and 38 inches (majority, 31 to 32 1/2 inches).

Paints. Colors seen in the decoration of arrows are red, green, black, brown, and reddish-brown. Pigments: oxide of iron, copper carbonate, and lamp black or an oxidized vegetal substance producing the black. Binder: either a viscous plant juice or mesquite gum which according to Cornell is soluble in water and makes a good varnish.[57] Oxide of iron, copper carbonate, and the black mixed with this substance furnish shades of red, green, and black that cover well and even pile up on the surface. The binder alone, laid in a thin coat on the yellow reed, gives a light brown, while a red-brown is gained by adding a small percentage of iron oxide. Powdered specularite sprinkled on the black paint before it sets gives a sparkling appearance to the stripes. Iron oxide and copper carbonate mixed with water or oil was also used to color the unprimed wooden foreshafts and to dye the sinew wrappings.

Shaft Decoration. The embellishment of arrows, often very elaborate, is confined to the feathered end and to the foreshaft of the projectile. All painting at the proximal end was done before the feathers were attached to the shaft. Although the decoration may start at the nock, there is only 1 example (an incised design) in which it extends beyond the second sinew wrapping holding the feathers in place. The shaft at the sides of the nock above the wrappings of sinew may be left plain or given a coat of black, often brightened with a sprinkling of specularite. In the simpler decoration the space underneath the feathers may be solid red, green or black. Dyed bands of sinew add a pleasing effect to both plain and decorated arrows. The more elaborate crests are combinations of various widths of bands, spirals encircling the shaft, panels in conjunction with these combinations containing longitudinal, straight, and waved hair lines, vertical and horizontal rectangles, checkerwork, one with a meander, and other arrangements best described by figures 21 and 22. Only 2 arrows have waved, incised lines which appear under the feathering (fig. 22, nos. *14*, *33*). Possibly scoring or channeling the shaft was not practical, since the breaking of the bark or shell on the reed would cause it to split.

Foreshaft Decoration. A large percentage of the foreshafts are uncolored, while some are painted all over red, black, or green (1 specimen). On others the designs are quite elaborate, and on several specimens the decoration is more delicate than at the nock end of the arrows. There are 6 unusual foreshafts incised with either spiral, waved, or parallel straight lines, the latter so skilfully done as to have the appearance of machine work (figs. 20, nos. *18*, *19*, *41*, *42*; 76, *m*, *n*). Painted decoration consists of stripes of varying widths and wide bands in one or more colors, checkerwork bands, dotted bands, bands of dotted circles or squares, spirals (sometimes with dotted fills between them), waved longitudinal lines, and bands filled with delicately executed geometric figures (fig. 21, nos. *1–9*) much like those seen on the pottery.

Technically the handling of a sticky binder used as a varnish or in conjunction with a pigment is puzzling. That the substance was resinous was established by firing and by the action of acetone and alcohol as a solvent. By adding a certain amount of animal fat or oil to melted resin, it is possible to keep it liquid and prevent its hardening too quickly to spread with a brush. However, the finish on the arrow shafts does not scratch readily, as would be the case with a pine gum mixture, and from this it seems that the binder, or varnish, used must have been the soluble gum from mesquite, which was easily procured by scoring the bark on a living bush. That the paint on the arrows was of a consistency to flow freely, leaving stripes of uniform width, or hair lines, is exemplified in all instances. Apparently wide bands of this material, colored or uncolored, were applied to the reed and allowed to set to some degree. The panel was then combed with a toothed instrument, possibly the short, trimmed vein on a quill, which would act much the same as our modern graining comb. The paint laid on the smooth surface of the reed, or on a polished hardwood foreshaft, could be scraped away in this manner, leaving waved or straight longitudinal lines. At times the coat was scored spirally or horizontally with a sharp tool or a chisel-edged instrument, the latter method leaving the panel covered with minute rectangles. This process is clearly shown by particles of the paint that have been pulled by the instrument into spaces which previously had been scraped free of paint. When thinned, this mixture of paint, or the pigments mixed with water or oil, were

[57] Cornell, 1934a, p. 111.

spread either with a fine yucca-leaf brush, or more likely with a soft hairbrush. The narrow bands and delicate geometric designs seen on the foreshafts indicate an exceptionally steady hand of a skilled artist.

Ingenious tricks appear, requiring not so much skill. One of these is the zone covered with extremely narrow spiral lines. Under the glass it was discovered that first the shaft had been wrapped with either a fine thread of sinew or a hair, and then the band had been given a coat of paint. After the paint had set, the thread was removed, leaving a figure that could have been produced in no other way.

It is evident that considerable pride was taken in the decoration of arrows, and it was even discovered that individual fletchers could be recognized by the sets having identical crests painted either on the nock end or on the foreshafts. The exceptional workmanship displayed in the arrows is in direct contrast to the time expended on the bows, which, with only 1 or 2 good points, are very inferior and have little or no ornamentation.

As so often is the case in examples of this weapon made by primitive people, the length of the bow to the arrow is out of balance, yet the specimens just described, bows averaging 48 to 49 inches long used with arrows 31 to 32 inches long, are in better proportion.

The care taken in the manufacture of arrows, which are straight light reeds, seldom overbalanced by too heavy foreshafts, would result in an unwavering flight. The very small, keen-edged obsidian points could not be termed broadheads, yet arrows so tipped and cast by a bow of even moderate weight would be effective. If the arrow did not strike a bone, it would penetrate an animal, and the game would eventually die from internal hemorrhages.

In revising the number of whole and fragmentary arrows from the 2 areas, it can be seen that only 8 1/2 per cent came from the Hueco area. On the hypotheses that wooden *tablitas* and reed cigarettes signify Pueblo traits (which may not be entirely correct), 5 caves in the Huecos producing fragments of reed arrows showed ceremonial usage by the Pueblo. One of these was Ceremonial Cave, which was so named not from its meager surface Pueblo content, but from a large deposit of undoubted Basket-maker ceremonial material. That the cave continued to be used in Basket-maker III times, when the bow and arrow probably began to supersede the atlatl and dart, is strongly indicated by the presence of 2 small hardwood bunts, one with its tang inserted into a reed arrow shaft. The fact that the arrow bunts are miniature duplicates of the large bunts suitable for darts, both of which were found in Ceremonial Cave, shows a "carry-over" of a former idea applied to a new weapon.

No doubt the greater number of arrows left in the caves of the Upper Gila had a religious significance. In most of the caves in that area some ceremonial objects were in evidence. Four sites, Doolittle Cave, Steamboat Cave, Mule Creek Cave, and Cave 1, Goat Basin, were particularly sacred shrines, where were gathered, respectively, 642, 304, 365, and 191 arrows and fragments. Since the caves had been disturbed, there is no way of telling how many arrows had been taken away previously by vandals. In these deposits both plain and painted arrows were left, thirty-one of which have paho wrappings of cord to make them more potent (fig. 122). Another observation made in comparing arrows from the Hueco area with those from the Upper Gila was that only a few from the Hueco caves were painted; all appear to have had simple pointed wooden foreshafts and seem to have been used more for service than as offerings. This may bear out the contention that the elaborately decorated arrows were prepared only for sacrificial rites, yet it does not seem unreasonable to think that such well-finished projectiles would at times have been considered more effective than plain ones when used in the chase.

Fur Cloth (figs. 23, *a;* 64, *b*)

Source. Upper Gila area—Steamboat Cave; Mule Creek Cave; Cave 1, Goat Basin; Kelly Cave. Hueco area—Ceremonial Cave; Cave 1; Cave 6; Picture Cave; Chavez Cave.

Materials. Yucca cordage (mostly *Yucca elata*), stripped rabbit hide, a limited amount of oxide of iron for coloring.

Technique. All cordage upon which strips of fur-covered hide are wound is 2-ply (1 example of 4-ply). The majority of cords are twisted left and the majority of hide strips twisted right. The ends of the hide strips wound around strings are threaded through the strands of the cordage. Fur string not on a cord is composed of 2 ribbons of hide twisted together. Additional pieces are usually attached by bending and looping the ends together or by puncturing the ribbon, threading the extra strip through the hole, and tying a small overhand knot on the end to prevent it from pulling out. Both square and overhand knots appear in this type of fabric. The technique of weaving is exemplified by detailed descriptions of 1 fragment of a blanket from the Upper Gila and a fragment and 2 fairly complete blankets from the Huecos.

Size. The cordage is 1/16 to 1/4 of an inch in diameter (majority, 3/32 of an inch). Strips of hide were cut from 1/8 to 5/16 of an inch in width. The sizes of the blankets are given as nearly as possible in their description.

Decoration. No attempt at embellishment or decoration was seen except on some blanket fragments from Chavez Cave in the Hueco area, where remains of the fur and hide wrapped around the cord were stained red. It is possible that these pieces were not woven into a blanket but served as waist cords or for adornment. In the same area some of the cordage was colored red, and from the Upper Gila an occasional cord was variegated by dying one of the strands red, which seems unnecessary since it was concealed in the finished product.

Fur-cloth Blanket Corner from Cist in Mule Creek, Upper Gila Area (fig. 23, *a*). All cords are 2-ply, left-twist yucca fiber, covered with right-twist wrappings of stripped rabbit hide (fig. 23, *a*, 1). The body is of looped strands of fur string, held in place by twined yucca cords which loop around pairs of fur strings (2). A selvage of 4 fur-string cords is attached to the sides by the twined binding cords, and at the end by a single yucca cord which is wound around them and passed through each pair of looped fur-string warps (3). All knots are the square, or reef, knot.

The length of 2 looped fur-string warps indicates that the blanket was 24 1/2 inches long; width could not be determined. Binding cords are spaced 1 1/2 to 2 inches apart. Two of the yucca binding cords have been variegated in color by dying 1 strand red.

Fur-cloth Blanket from Cave 1, Hueco Mountains (figs. 23, *b;* 64, *b*). This large fur-cloth blanket was found wrapped around the body of an adult. The cordage, which is pliable 2-strand yucca fiber, is twisted right, as are the rabbit-fur strips. The body of the blanket is made of series of looped warps (fig. 23, *b*, 1), composed of 2 ribbons of hide twisted together. These warps are held in place by pairs of twined cords (2), which encircle each strand of the fur-covered warp. The binding cords are tied together at the ends, usually with an overhand knot, and occasionally with a square knot. To strengthen the side selvage, the 2 warps of which it is composed (3) are cords wrapped with stripped hide (cords dyed red). The end selvage is reinforced by an extra heavy yucca cord (4) threaded through the looped warps, above the first course of twined binding cords. One corner shows a loop of cord tied into the selvage, presumably used in tying the blanket around the shoulders of the wearer.

The length of the blanket through the binding cords is 59 inches; width through looped fur string warps is 38 inches. The twined binding cords are spaced 1 to 2 1/2 inches apart.

Fur Cloth from Cave 1, Hueco Mountains —Infant (fig. 23, *b*). This fur-cloth covering was wrapped around the young infant found with the above adult burial. It is a fragment of a large blanket, with a short length of the end showing twining of the yucca binding cords, some of which are dyed red, and a heavy reinforcing cord through looped warps, the same technique as that just described and shown in figure 64, *b*.

Fur-cloth Blanket from Ceremonial Cave. Shreds of a blanket with a burial in Ceremonial Cave (fig. 63, *b*) show warps of 2 right-twist fur-covered strips of rabbit skin, twisted together, and each warp held in place by 2-strand, right-twist twined-yucca cords. There is no additional strengthening of the selvage along the loops of fur-string warps other than the first twined cords. Binding cords are spaced 2 to 3 inches apart.

Results of the study of the technique show that all specimens of fur string from the Upper Gila were strips of hide wrapped around cords, while in the Hueco area, although this method was in use, most of the fur string was made by twisting together 2 ribbons of hide, without a reinforcing cord.

Fairly complete specimens of fur-string blankets and quantities of fragments recovered by ourselves in the Upper Gila and Hueco areas possibly indicate the use of such garments in the Pueblo periods, and without doubt in Basket-maker times, since fur-cloth-wrapped bodies with undeformed skulls were accompanied with baskets and other Basket-maker furniture in caves of the Hueco Mountains. The same applied to the lower reaches of the Pecos River, where fur string was discovered by Martin and by Pearce and Jackson and a burial with such a blanket by Setzler. From this evidence there is reason to believe that such robes were also of early origin in that district.[1]

Feather Cloth. This is represented in the collection by a specimen from the Upper Gila area. One is a bundle of cedar twigs from Cave 1, Middle Fork of the Gila, tied with a piece of feather-cloth string made by wrapping a heavy 2-ply yucca cord with the vanes stripped from the quill (fig. 67, *b*). The other is composed of decayed fragments of a blanket found with a disturbed adult male burial in Cave 2, West Fork of the Gila. All that can be determined about this specimen is that strips of bird skin were wrapped around small 2-strand right-twist yucca-fiber cords. Pieces show that both warps and wefts were feather strings, and that 1 warp lay close to the side selvage made up of overlapping bends of weft strands. Although pieces of darts were found in the cave, the artificially flattened back of the skull in the burial shows that the blanket could not be dated earlier than Pueblo I.

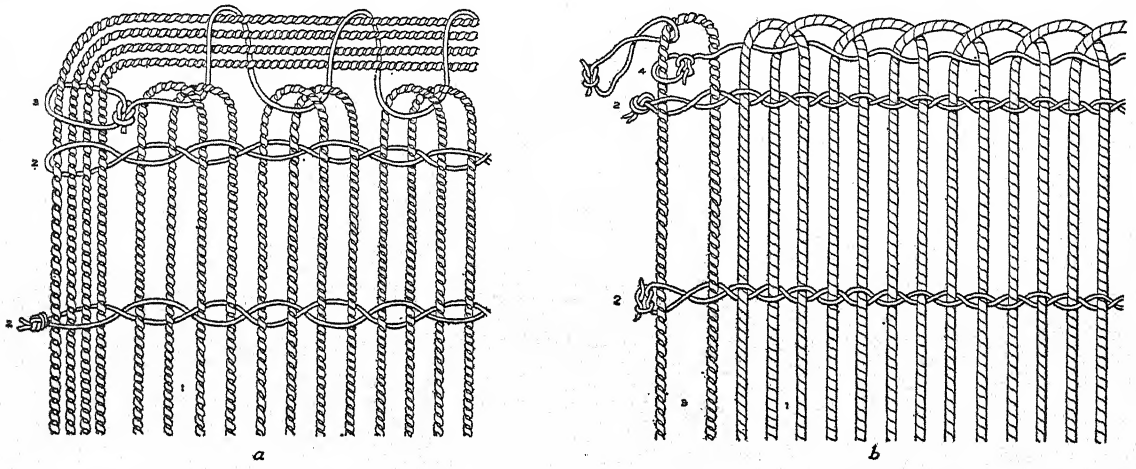


Fig. 23. Weaving and selvages of fur-cloth blankets. *a*, corner fragment of fur-cloth blanket from cist in Mule Creek Cave: (1) fur-string warps, ribbons of hide wrapped on yucca cord, (2) twined yucca-cord wefts, (3) yucca cord attaching selvage to bends in warps; *b*, large fur-cloth blanket from Cave 1, Hueco Mountains: (1) fur-string warps, 2 ribbons of hide twisted together, (2) twined yucca-cord wefts, (3) selvage, ribbons of hide wrapped on red-dyed yucca cord, (4) yucca cord reinforcing selvage along bends of fur-string warps.

Cordage (fig. 77)

Sources. Nearly all sites investigated.

Materials. Yucca (probably *Yucca macrocarpa* and *Yucca elata*).

[1] Martin, 1933b, p. 46. Pearce and Jackson, 1933, p. 90. Setzler, 1933, p. 37.

sotol (*Dasylirion Wheeleri*); apocynum; cotton; human and animal hair, some of the latter identified as bear; coarse fibers of the agaves and bear grass (*Nolina microcarpa*) not so commonly used.

Yucca elata can be reduced to extreme fineness. The visible fiber, which itself is a bundle of finer fibers, breaks down with the carding and spinning into its constituent parts to make soft strands in an unusually pliable cord, which can easily be mistaken for apocynum or like bast (figs. 77, *b–d* and *g*).

Technique. Hundreds of pieces examined show that strings were generally 2-strand. In yucca they were made of as many as 4 strands, and in cotton, 2 to 9 strands, and bundles of 14 to 15 strands in loose soft cords. Both coarse and fine fiber yucca were twisted into loose or tight cords. In 2-strand yucca cordage 73 per cent was twisted left, indicating a predominance of spinning the strands to the right. The reverse of this was applied to cotton, in which most of the strands were spun to the left. The ends of the cords were sometimes tapered. The square knot was in general use, the exception being an occasional overhand knot, and in only 2 examples was the careless granny knot seen. True splicing was not often attempted, but 1 specimen shows a rough laying in and twisting together of strands in this way.

Size. Two-strand or more, 1/32 to 1/4 of an inch in diameter.

Decoration. The yucca cords were stained with a wet dye in red, yellow, and black, and the same colors rubbed on the strands, either dry or in the form of a paste. The reds shade from light to a dark red-brown. In 2 specimens, like figure 77, *d*, the black is not permanent and will rub off. Cotton was wet-dyed red, yellow, green, and black, and dry-dyed, yellow. In cotton the black is permanent. Two examples of decorative yucca cords show red or brown strands twisted with strands of natural color. One specimen of dry-dyed yellow cord is wrapped with pieces of quill and appears to be what remains of a feather necklace or wrapping for a paho. A yucca cord, spirally wrapped with narrow strips of cornhusk, large soft cotton bundle cords, and single- and multiple-yucca-whipped cords were probably used on prayer sticks.

Hair was not in general use. One piece of 2-strand brown-black human-hair cord was found at Saddle Mountain, San Francisco drainage, and another (fig. 118, *b*), tied to a twig paho from Doolittle Cave, also in the Upper Gila area. An 8-strand heavy cord was used to tie the neck of the antelope-skin pouch from Chavez Cave, Hueco area (fig. 127, *d*). The largest amount of white and brown animal-hair cordage was found at Chavez Cave in the Hueco area.[2] All animal-hair cordage was right twist, while human-hair cordage was left twist.

In both areas the principal material used was yucca. All fibers in the Huecos were yucca except in Caves 8, 9, and 10, principally Puebloan, where fragments of cotton were found. In the Upper Gila yucca was the staple, yet cotton was found in considerable amounts in the form of skeins of spun yarn (fig. 77, *e*), and in soft cordage used in stringing beads and tying objects to pahos. Although Basket-maker remains appear in the Upper Gila in sites occupied and visited by the Pueblo, yet it is interesting to note that cotton was not known to the Hueco Basket-makers. In both areas *Asclepias* (milkweed) and *Apocynum* (dogbane or Indian hemp) cordage appeared in limited quantity but such bast fibers make no softer string than those, just described, from the bundled fibers of *Yucca elata*. Chavez Cave, in the Hueco area, produced the finest example of the latter material, in the form of a large hank of smooth silky string (*b*).

The pottery disc (fig. 77, *a*) cached with *c*, *d*, *g*, and *h* (a bunch of grass, cedar bast, and a piece of buckskin) appears to be an undrilled whorl suitable for a spindle like *f*. The cache came from Greenwood Cave of the Upper Gila, the spindle came from Ceremonial Cave in the Huecos.

String Aprons (fig. 78)

Source and Quantity. Upper Gila area—Mule Creek Cave, 4 specimens.

Materials. Cotton and yucca fiber.

Technique. Apron *a* is of left-spun looped single cotton strands, full of kinks. The top is bound by 5 wraps of a loose right-twist 8-strand cotton cord, and 2 waist cords of same size are passed through this whipping. The size of the apron is 9 inches long, 4 1/2 inches wide; the longest strand of waist cord is 32 inches.

Apron *b* is of 2-strand left-twist yucca-fiber cord. The long strands at the center are wrapped loosely by a skein of 9 cords and held flat by a

[2] The white hair has been identified as goat, so it may be post-Spanish.

cord wrapped around this skein, separating groups of strands. Some strands are 30 inches long. An impression of a girdle is given in the illustration, but in use the strands were probably looped over a waist cord at the back, making an apron 14 to 15 inches in length.

Apron *c* is a bundle of right-twist single-strand yucca-fiber cords, drawn into kinks from the spinning. This bundle is wrapped and tied at the center, allowing the free ends to hang in a mat. The apron, in its present state, measures 6 inches long by 7 inches wide. The cordage is dyed red, and as an additional decoration, a discoidal pink *Spondylus* shell bead is held by 1 strand of the wrapping cord at the top.

Apron *d* is of loose left-twist 2-ply yucca-fiber strands, bound at 1 end by a knotted skein of cotton. Through this binding are 11 8-strand loosely twisted cotton cords, probably representing the remains of a waist band. The present length (apparently only half of the apron) is 10 inches and the width 5 inches.

Plain-weave Cotton Cloth (fig. 79, *a–d*)

Source and Quantity. All in Upper Gila area—Doolittle Cave; Cliff Ruin 7, Sapillo Creek; Cave 5, Sipe Canyon; Mule Creek Cave—7 specimens.

Material. Cotton.

Technique. All warp and weft threads are 1-ply, twisted to the left. The warps are spun tighter than the wefts, which at times show only a slight twist. Of the warps and wefts of 5 specimens, the number of threads to the inch, respectively, is 16 and 14, 20 and 18, 30 and 28, 32 and 24, 32 and 24. Two specimens, with warp and weft uniformly twisted, have 20 and 20, and 42 and 42 threads to the inch. The latter specimen, judging from its cleanliness and fine weave, is possibly of late origin, carried into the cave by rats.

In specimen *b*, a corner fragment, the side selvage is reinforced by 2 pairs of twisted threads twined through the weft loops, and the end selvage formed by the warp threads, passed and interlocked around 1 or 2 wefts as they are carried to the corner. At the junction 6 multiple strands are assembled and plaited into a round cord in such a manner as to leave a row of diagnoal stitches on either side, while the free ends are tied in pairs and closely trimmed, leaving a knob end rather than a tassel.

The fragment *c*, dyed red, has a reinforced selvage, made by attaching a heavier 2-ply cord with its strands twined through the looped wefts as in the selvage at figure 30, *b*.

Specimen *d* (fig. 79) illustrates the loose, sleazy type in this technique.

The small quiver-shaped object, *a*, from Mule Creek Cave, San Francisco drainage, is plain weave, with the body showing 32 warps and 24 wefts to the inch. At the top a 1 1/4-inch band is produced by the use of heavier weft threads. A 2 1/2-inch cuff at the bottom is a checker pattern made by grouping 3 or 4 warps, through which pairs of heavy weft threads are woven (warp clusters, 12, weft pairs, 13 to the inch). The top and bottom selvages are reinforced by strands of a 2-ply cord, twined through the looped warps. The ends of these selvage cords are tied with a square knot at the seam joining the edges of the fabric. The selvage has no additional reinforcement. The sides are sewed together with a whipping of cotton thread and with broken stitches, replaced in 3 places by ties of fine yucca fiber. Apparently the top and bottom cords were twined through the warp loops before the keystone-shaped piece of fabric was woven. This was afterward folded and sewed together. The length of the specimen is 10 1/2 inches; width at top, 4 inches; width at cuff, or bottom, 1 3/4 inches. Because it is still sewed along the side, and because of its size and the non-flexible weave of the cuff, it seems that this object could not have been used as a legging, even for an infant. Although the end is not closed, it strongly suggests part of a quiver, since the weave of the cuff, or small end, is identical with an elaborately woven cotton quiver containing 20 arrows, recently found with a burial in the caves of the Verde River Canyon of Arizona and now at the University of Arizona Museum.[3]

Plain-weave Wool Cloth

Source and Quantity. Upper Gila area—Doolittle Cave, 1 fragment.

Material. A rather coarse wool.

Technique. The threads are 1-ply twisted to the left. One series (probably warps) contains 29 threads to the inch, while in the opposite series are 16 threads to the inch. The fabric, which is dark brown in color, is somewhat coarse, but compact, and woven as might be a homespun.

[3] Personal information by Dr. A. V. Kidder.

The specimen suggests a piece of heavy native Mexican-made cloth that might have been stolen by Apaches raiding this section in historic times.

Twined Weaving

Source and Quantity. Upper Gila area—Kelly Cave, 1 fragment of a bag.[4] Hueco area—Chavez Cave, 1 complete bag; Ceremonial Cave, 1 fragment.

Material. Yucca fiber.

BAG FROM CHAVEZ CAVE (figs. 24, 80, *a*). In this specimen the warps and wefts are 2-ply cords, some twisted left and some twisted right with 6 warps to the inch. At the bottom there are 14 wefts, increasing to 18 at the top. The bag was started at the base with 6 heavier warps laid parallel and 2 lighter warp strands bent and interlocked across them. A weft was bent around 2 of these warps, and the twining with the double weft was then started, separating and spacing the 16 initial warps, as in figure 24, *a*. To increase the size of the bag, pairs of additional warps were inserted, either by looping a cord between two of the old warps and holding them in place by the succeeding twining (*b*), or by placing the looped cord behind one of the old warps and holding the new strands on either side of it with the twined wefts, as at *c*. Occasionally a single warp would be inserted by bending the end around behind an original warp and binding the short end against the adjoining warp with the twining, as at *d*. To decrease the size of the bag, which is globular in form, occasionally warps were eliminated by joining and twisting them together as they neared the top of the bag.

In Basket-maker bags from northern Arizona Guernsey and Kidder discovered the method *a* of inserting warps, also one nearly the same as *b* except that the old warp was threaded through the strands of the new warp.[5]

For the selvage at the mouth of the bag, each warp was bent down at the edge to lie along the side of the succeeding warp and held in place by 6 to 8 courses of wefts before it was trimmed.

The bag is 3 1/2 inches in diameter, and nearly spherical, with the mouth or opening 1 1/4 inches in diameter.

Decoration consists of a 1 1/2-inch circle in undyed cords at the base; next a 1 1/4-inch band in bright red; then a 1 1/8-inch solid band in clear yellow, followed by the 1 1/4-inch rim band in a much darker red-brown color. The weft cords are thoroughly stained with the dyes, which are unusually clear. The warps are dyed a red-brown color.

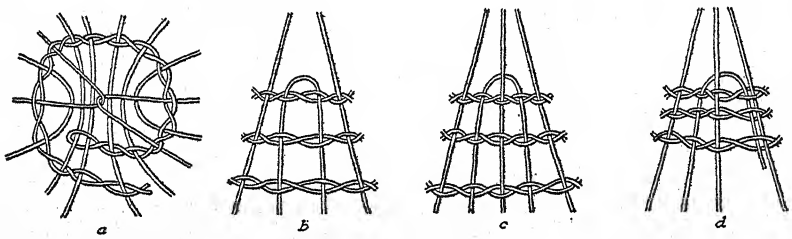


FIG. 24. Base and 3 methods of laying in additional warps in the twined-woven bag from Chavez Cave.

SPECIMEN FROM CEREMONIAL CAVE (fig. 79, *f*). In this the warps and wefts are 2-ply cords twisted left, with 7 warps and 12 weft pairs to the inch. One cord in each weft pair is dyed red, producing a "beaded line."

The small fragment, which appears to be part of a bag, shows no decoration other than the manipulation of the colored weft which is described above.

FRAGMENT OF BAG FROM KELLY CAVE (figs. 25; 79, *g*). The warps and wefts are 2-ply cords twisted left, 11 warps to the inch. In the natural, undyed, base are 12 weft pairs to the inch; in the red band, 15 weft pairs to the inch; in the black and natural band, are 16 weft pairs to the inch.

The large torn piece of bag from which this specimen came is 18 inches long. One edge is reinforced with cord, wide-spaced in a buttonhole stitch. Since only part of this specimen is in our possession, the arrangement of warp cords in the base preliminary to the twining of wefts, and

[4] A small fragment of twined-woven fabric was found by Wesley Bradfield at Doolittle Cave, Mimbres Valley, Upper Gila area. It is a yucca fiber with natural color and red-dyed weft cords. All cords are twisted left.

[5] Guernsey and Kidder, 1921, pl. 27, *a*, *b*.

the method of inserting additional warps to increase the diameter of the bag, cannot be given. No knots show in the wefts, indicating that they have been extended by additional lengths of cords twisted in.

For decoration, the undyed bottom of the bag shows a twined-woven base 13 inches in diameter, above which is a 1 5/8-inch twined-woven band in solid red. Next is a 1 1/8-inch natural- and

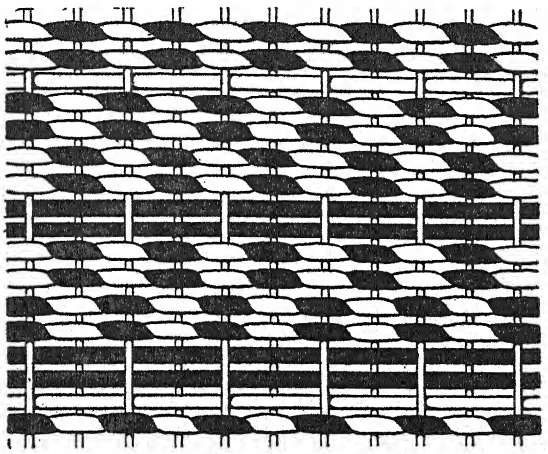


FIG. 25. Decorative band in the fragment of a twined-woven bag from Kelly Cave.

black-thread band, woven in reversed sets of black and natural twined wefts, separated by 1 to 3 wefts in plain weave (over-1-under-1), as in figure 25. Above the black and natural band, the solid red extends to the end of the fragment. Since these decorative zones are close to the base, it is probable that originally more bands were incorporated in the bag toward its top. All cords, both black and red, are thoroughly colored, indicating a wet dye rather than a dry color rubbed into the fiber. This specimen, a piece of a large fragmentary bag, was given to the Museum by R. C. Eisele, who found it in this cave previous to our investigation of the site.

Plain Coiled Netting (figs. 26, *a;* 80, *b*)

Source and Quantity. Hueco area—Chavez Cave, large coiled-netted bag.

Material. Asclepias (milkweed).

Technique. The strings (3/32 of an inch in diameter) in the body of the bag are soft twist, 2-ply cordage, twisted left; a heavier extra cord reinforcing the selvage is twisted right. Vertically there are 8 coils to the inch, and each row of coils has 5 loops to the inch. Work was started at the bottom of the bag by coiling and overlapping the end of the cord, followed by looping 8 buttonhole stitches into this initial coil (fig. 26, *a*). The end of the cord was then pulled to draw the stitches tightly together, after which the buttonholing, or coiled netting, was continued by placing the stitches around the bends of the cord between the first circle of loops. To increase the size of the bag, 2 stitches were inserted instead of 1, and to constrict the bag toward the top, this operation was reversed by dropping stitches. The continuous cord used in the process was lengthened when required by attaching additional sections with a square knot. The tight selvage was strengthened with a loose buttonhole stitch, made of heavier cord.

Size and Shape. The bag is globular in form. Its greatest diameter is 9 1/2 inches; height, 10 inches; diameter of orifice, 4 1/2 inches.

The large cords in the specimen make a heavy, strong bag, which shows wear yet is in perfect condition.

Full-turn Coiled Netting (figs. 26, *b;* 81, *f*)

Source and Quantity. Upper Gila area—Greenwood Cave; Steamboat Cave; S. A. Canyon, Cliff Ruin 1; Cave 1, Middle Fork; Kelly Cave; Cave 3, Goat Basin. Hueco area—Ceremonial Cave; Cave 1; Cave 5. Ten specimens of carrying nets.

Material. Leaves of the yucca, principally *Yucca macrocarpa.*

Technique. Strips of the plant leaves were partially softened, and the strands either left straight or, in the better nets, given a slight right or left twist, forming a heavy cord 5/16 to 3/8 of an inch in diameter. The cords were joined with square knots. The meshes are 3 to 4 inches in size. There was no intentional shaping, but apparently the piece of net was drawn into a sack of desired size with a lacing through the loops of the selvage.

Although more specimens of carrying nets came from the Upper Gila caves, yet a few pieces of nets and numbers of burden-strap fragments from the Hueco area show that this quickly made container was used farther south.

Knotted Coiled Netting (figs. 26, *c;* 82, *j*)

Source and Quantity. Hueco area—Ceremonial Cave, bottom of 1 bag and 1 fragment.

Material. Yucca-fiber cord and split yucca leaves.

Technique. The 2-strand cordage was twisted right. The work was started on an open slipnoose (fig. 26, *c*). The long cord was then fastened to the open loop in a series of 13 slipknots, which were afterward pulled into a circle by drawing the short end and tying it off closely with an overhand knot. Following this, the knotting was continued spirally by attaching the loop of each knot to the strand connecting the preliminary series. Thus a circular piece of fabric grew in size, and although the specimen is incomplete, enough remains to show that a bag was formed by dropping stitches, or knots, as the work progressed toward the top. The meshes in the bag are under 3/16 of an inch, and it seems that it could have been fabricated only with some kind of needle.

Another fragment of a small bag, in poor condition, shows this method of netting with strips of yucca leaves. Necessarily the meshes are larger and uneven in size, and the slipnooses in the fabric are not drawn tightly.

Coiled Netting on Warps (figs. 26, *d*; 79, *e*)

Source and Quantity. Upper Gila area— Steamboat Cave, several fragments.

Material. Warps and wefts, yucca fiber.

Technique. Both warps and wefts are 2-ply cords twisted left, warps somewhat tighter twist than wefts. There are 8 warps and 11 loops to the inch. The first series of loops takes in the outer warp strand, and each loop in the next row includes a warp as it encircles each bend between the loops of the preceding row. When beaten down, the result is a strong, attractively woven fabric.

Decoration. The textile is light red in color. Because the centers of the warp and weft cords show the natural tone of the fiber, it appears that the color was obtained by rubbing moistened pigment on the twisted strands, rather than by staining the fibers throughout by soaking them in dye. This condition is also shown where raised cords on the surface of the fabric have worn to a lighter shade.

The small fragments, all from the same piece, give no clue as to whether the material was woven as straight cloth or in the form of a bag.

Netting (figs. 27; 82, *a–i*)

Source and Quantity. Upper Gila area—Doolittle Cave, 6 fragments. Hueco area—Chavez Cave, 5 fragments; Ceremonial Cave, 6 fragments; Cave 5, 2 fragments; Cave 7, 2 fragments; Cave 8, 12 fragments.

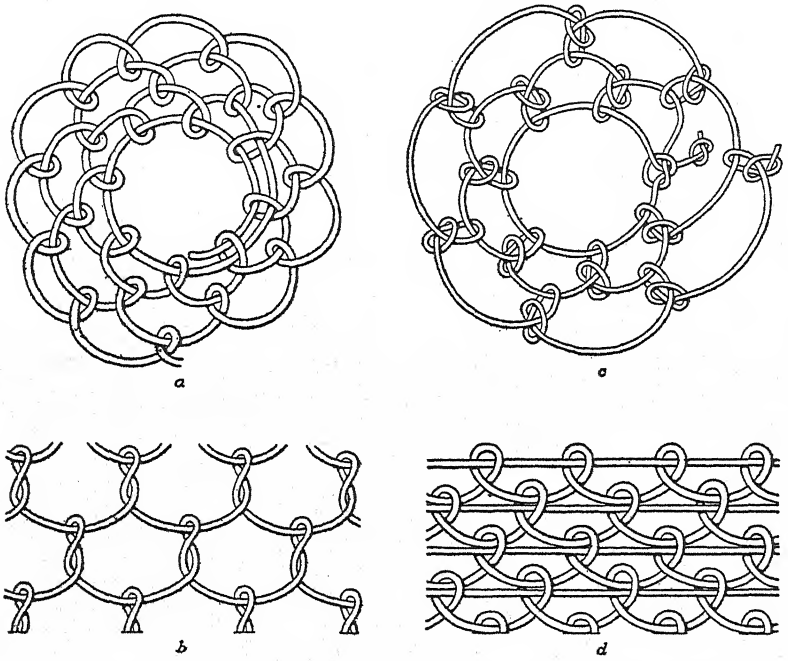


FIG. 26. Coiled netting. *a*, plain; *b*, full-turn; *c*, knotted; *d*, on warps. *a*, Chavez Cave; *b*, *d*, Steamboat Cave; *c*, Ceremonial Cave.

Material. Principally yucca fiber; 2 specimens from Cave 7, Huecos, woven with *Asclepias* fiber (milkweed).

Technique. One specimen is 4-strand, while all the rest are 2-strand cordage. There is an equal division of right and left twisting in soft to medium-hard-laid cords. The only type of knot, the sheet bend or weaver's knot, used was that shown in figure 27. Commonly in tying, alternate knots were reversed, but 4 exceptions were noted where, through studied effort, the knots were not reversed but all were made to face the same way on the fabric.

The cords vary from 3/64 to 1/8 of an inch in diameter. The small meshes in the fabric are from 1/4 to 5/8 of an inch, while the large meshes

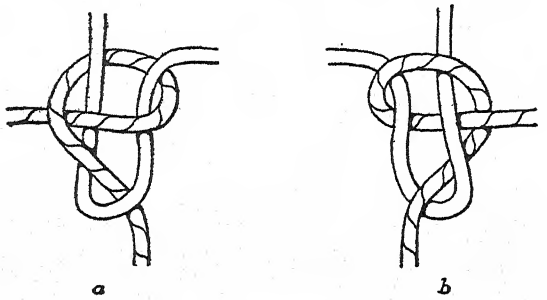


FIG. 27. Two sides of sheet bend or weaver's knot used in netting.

are 1 1/4 to 2 1/2 inches. The slight variations in dimensions of the mesh show accurate spacing, either on the finger or with a gauge. However, no objects were found which could be identified as netting gauges.

The pieces of netting with 1/4-inch to 5/16-inch meshes were probably parts of bags or small containers, while those having 1 1/4-inch to 2 1/2-inch meshes were possibly from nets used in trapping small game. Forty per cent of the netting fragments came from Chavez Cave, which is situated close to the Rio Grande, and since fish vertebrae were found in the refuse of this site, it furnishes us with the only instance in which nets might have been used for seining. Apparently catching fish with a dip-net was practised farther down the river, for Martin shows one attached to a hoop and pole, found with a burial containing baskets and other artifacts in Cave 5 of the Shumla group. At what he terms "old Shumla" cave he also found a long 1-inch mesh sheet bend knotted net that was wrapped on 3 pointed sticks. The pointed sticks suggest its use as a rabbit net, yet it could have been used for fishing.[6]

[6] Martin, 1933b, pls. XL, XLIV, no. 2; and p. 53.

Narrow Fabrics, Plain-weave

HEADBANDS (figs. 28, *a–d*; 83, *f–h*)

Source and Quantity. Upper Gila area—Kelly Cave, 1 complete headband; Doolittle Cave, 4 fragments.

Material. Yucca fiber.

Technique. In figure 83, *f*, a complete headband, the main parallel or warp strands are rather stiff and the wefts are somewhat softer. All cords are 2-ply, twisted left. The band consists of 20 strands, with a loop at either end formed by dividing the strands into 3 clusters on each side and binding them together with a plain weave of cord. These clusters are gradually reduced in number until a single bundle remains which is given a cord whipping. The strands between loops are held in alignment by red-brown-dyed wefts, woven across them in plain weave to produce a design consisting of 2 double key figures with saw-tooth inner edging. The body and loop whipping cords are the natural color of the fiber. The total length of the band is 19 inches; width, 2 inches; length of loops, 1 1/2 inches.

In figure 83, *g* and *h*, 2 of the 4 similar fragments of headbands, the 2-ply left-twist warps and wefts are 1/16 of an inch in diameter or slightly less. In these specimens the combinations are 18 warps–6 wefts; 20 warps–8 wefts; 28 warps–8 wefts; 30 warps–6 wefts to the inch. Judged by specimen *g* (the one with the loop, also shown in fig. 28, *d*), these carrying straps were started as a skein, with 1 strand becoming a binder, or weft, woven over and under back and forth across the parallel cords or warps. In this technique the weft is concealed and the warps form the visible surface of the band. Variation in compactness of weave can be seen on figure 83, *g*, which has 18 warps and at *h* with 30 warps to the inch. Strands forming the loop on *g* are bound together by an independent whipping of cord. The original lengths cannot be determined, but the width of *g* is 1 3/8 inches and that of *h*, 1 inch.

Guernsey and Kidder show Basket-maker II headbands which in weave are much the same as *g* but with the minor difference that the weft is independent and not one of the strands.[7]

BURDEN STRAPS (fig. 81, *a–e*).

Source and Quantity. Upper Gila and Hueco areas; fragments of the coarse yucca burden straps.

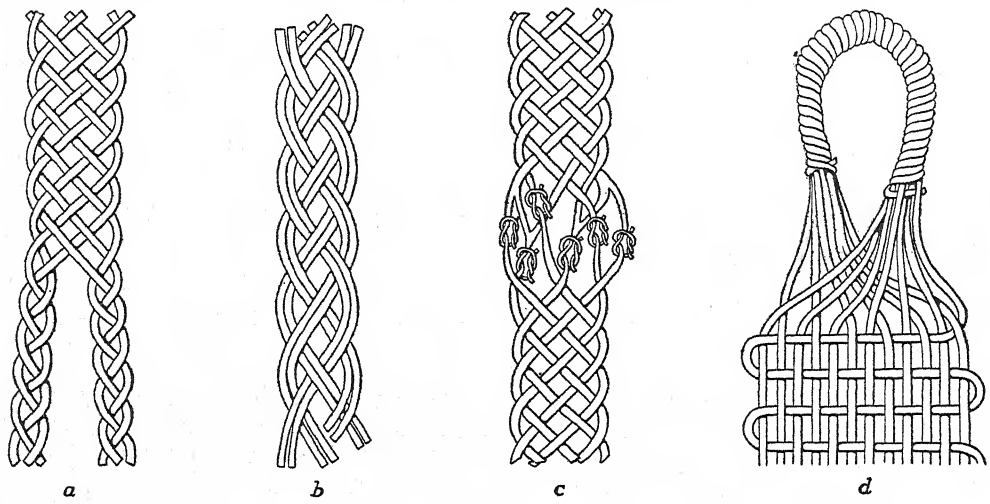
Material. Commonly the heavy leaf of the *Yucca macrocarpa;* occasionally bear-grass leaves (*Nolina macrocarpa*).

[7] Guernsey and Kidder, 1921, pl. 27, *f*.

Technique. To form loops on the ends of a strap, the butt ends of yucca leaves were bent over and held down by from 1 to 4 warps of a strip of the same material 1/8 or 3/16 of an inch wide. The winding strip was then stitched through the leaf and around the whipping from 2 to 5 times to hold the loop securely, as in *b–d*. For additional length, partially shredded leaves, and occasionally beargrass leaves, were tied with square knots to the ends of the loop straps, as shown by the forehead section, *a*.

At Tularosa Cave in the Upper Gila Hough also found ends of heavy pack straps made of yucca leaves, showing an ingenious method of holding the loop, through which a wooden toggle was passed, and to which either the shredded yucca leaves or the cords of the burden container were lashed.[8]

This type of burden strap was no doubt attached to the coarse yucca coiled-netted containers shown in figure 81 *f*, or to any load tied into a convenient bundle with yucca thongs, like figure 81, *e*.



a *b* *c* *d*

FIG. 28. Narrow fabrics, braided and plain-weave. *d*, a burden strap with loop on end. *a–c*, Ceremonial Cave; *d*, Doolittle Cave.

Narrow Fabrics, Braided (fig. 83, *a–e*)

Source and Quantity. Upper Gila area—Doolittle Cave; Cave 1, Goat Basin—8 specimens. Hueco area—Ceremonial Cave; Cave 6; Pinnacle Cave, Playas.

Material. Coarse and fine yucca fiber.

Technique. In bands of stiff straight fibers, the twist is hardly perceptible in the strands as they are smoothly plaited; in those made of 2-strand, twisted either left or right, the cords are softer. All specimens are plaited over-1-under-1 with 3, 6, or 8 strands; included with these is a square braid (fig. 83, *b*), having 8 strands.

Size. The widths of the specimens are 3/16, 3/8, 1/2, and 5/8 of an inch, and the square braid, 1/4 of an inch.

Specimens *a*, *c*, and *e* (fig. 83), of stiff fiber, are 3 and 6 strands; *a* and *e* are shown in figure 28, *a* and *c;* figure 83, *e* is 5/8 of an inch wide and shows 2 straps joined by tying ends of strands together with square knots. Specimen *d*, 1/2 an inch wide, is made of 8 2-ply cords, divided into pairs which are kept flat in the braid; 2 pairs are dyed red and the others the natural color of fiber (also shown fig. 28, *b*). Specimen *b* (fig. 83) and 8-strand square braid, has 2 strands dyed brown. In the braiding these strands appear along 2 edges of the braid diagonally opposite each other as pairs of dark stitches separated by pairs of lighter ones.

Narrow Fabrics, Twilled Cotton and Yucca (figs. 29; 84, *a–c*, *e*)

Source and Quantity. Upper Gila area—Mule Creek Cave, 4 fragments. Hueco area—Ceremonial Cave, 2 specimens.

Material. All Upper Gila specimens of cotton; Hueco specimens of yucca fiber.

Technique. In 2 pieces of cotton the thread is soft single-strand, twisted left, while in the others, the thread is 2-strand, twisted right. The

[8] Hough, 1914, *g*, *h*, figs. 145 and 146.

weaves are over-2-under-2 or over-3-under-3 (fig. 28, *a–d*). Widths vary from 3/8 to 5/8 of an inch. The selvage is gone from the frayed specimen, figure 84, *e*, which may have been a piece of cloth or part of a wide sash. All fragments but one are dyed red.

The yucca band (fig. 84, *b*) is made of 18 2-ply right-twist cords, pairs of which are plaited over-2-under-2. The loose end cords are held in a bundle by a wrapping of one of the strands, and finally secured by a whipping of sinew. The band is 5/8 of an inch wide. In the bands woven of yucca the fabric may be uncolored or some of the cords dyed either black or red. In 1 example, shown in figure 28, *d*, some of the cords are dyed black, some red, and some are left natural.

The band *c* (fig. 84), made of 6 narrow ribbons stripped from yucca leaves, is plaited over-1-under-1 and over-2-under-2. It is 7/16 of an inch wide. (Also shown at fig. 29, *a*.)

Narrow Fabrics, Spirally Wrapped Warps (figs. 29, *f*; 84, *d*)

Source and Quantity.—Hueco area—Ceremonial Cave; Chavez Cave—3 fragments.
Material. undyed yucca fiber.

Technique. This fragment is of fine 2-strand cords, twisted right in 2 specimens, twisted left in the other. The bands are made up of ribbons, containing 21 warps to the inch. Working upward, the warps are held together by a series of binding cords wrapped spirally around pairs of warps; that is, the first binding cord, wound to the right, takes in warps 1 and 2, and the second binding cord, wound to the left, takes in warps 2 and 3, while the third binder, wound to the right, takes in warps 3 and 4, and so on. When drawn taut, the exposed binding cords on the face of the fabric have the appearance of diagonal rows of crossed stitches.

Size. The specimen from Chavez Cave is 3/8 of an inch wide; those from Ceremonial Cave, 2 inches wide.

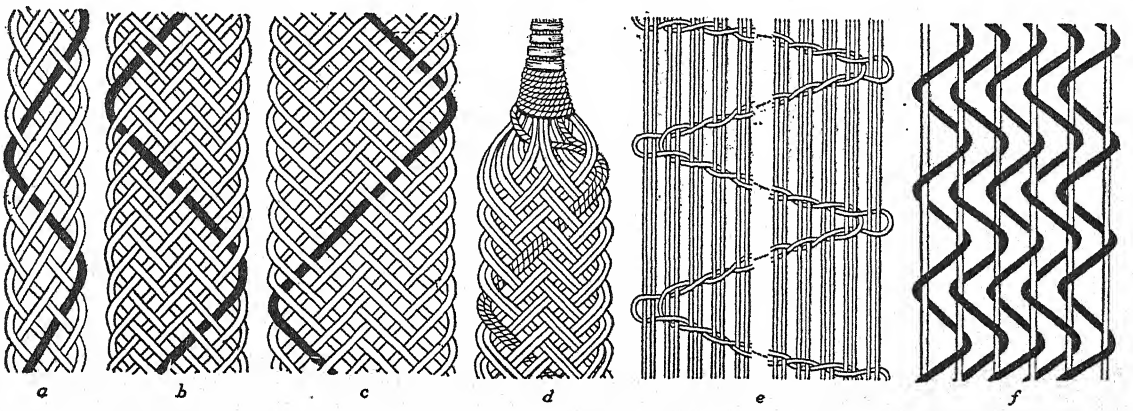


FIG. 29. Narrow fabrics. *a–d*, twilled; *e*, zigzag twined weft; *f*, spirally wrapped warps. *a*, *d–f*, Ceremonial Cave; *b*, *c*, Mule Creek Cave.

The pieces from Ceremonial Cave were with the disturbed Hueco Basket-maker burial (fig. 63, *b*).

Narrow Fabrics, Twined Weft Zigzag (figs. 29, *e*; 84, *f*)

Source and Quantity. Hueco area—Ceremonial Cave, fragments of a wide sash.
Material. Yucca fiber.

Technique. The smooth and tightly twisted cords are 2-ply, twisted left. The ribbon of 77 warps is held in place every 3/8 of an inch to 1/2 an inch along the selvage by zigzag courses of twined wefts which encircle pairs of warps. In this process the wefts become right-twisted 4-strand cords, and stand out in contrast to the closely laid warp web. Nothing remains of this piece which shows how the ends of the sash were finished.

Size. The length, approximated from the fragments, is judged to have been 38 inches; width, 3 1/2 inches.

Lace (figs. 30; 85, 86, *c*, *e*)

Source and Quantity. Upper Gila area—Greenwood Cave, 2 fragments; Mule Creek Cave, part of a band.
Material. Cotton.

Technique. In the specimen from Greenwood Cave, shown in figure 85, *a*, the fibers are loosely spun right into a strand the size of number 100 cotton thread. The fabric is made up of round 6-strand braids joined at regular intervals by an independent looped strand from opposite braids to make a net with a mesh less than 1/16 of an inch. The loops joining braids do not interlock. The specimen is so small (3/16 of an inch wide by 3/4 of an inch long) and the threads so fine and fragile that it is impossible, without destroying the specimen, to determine how they were manipulated in the braid.

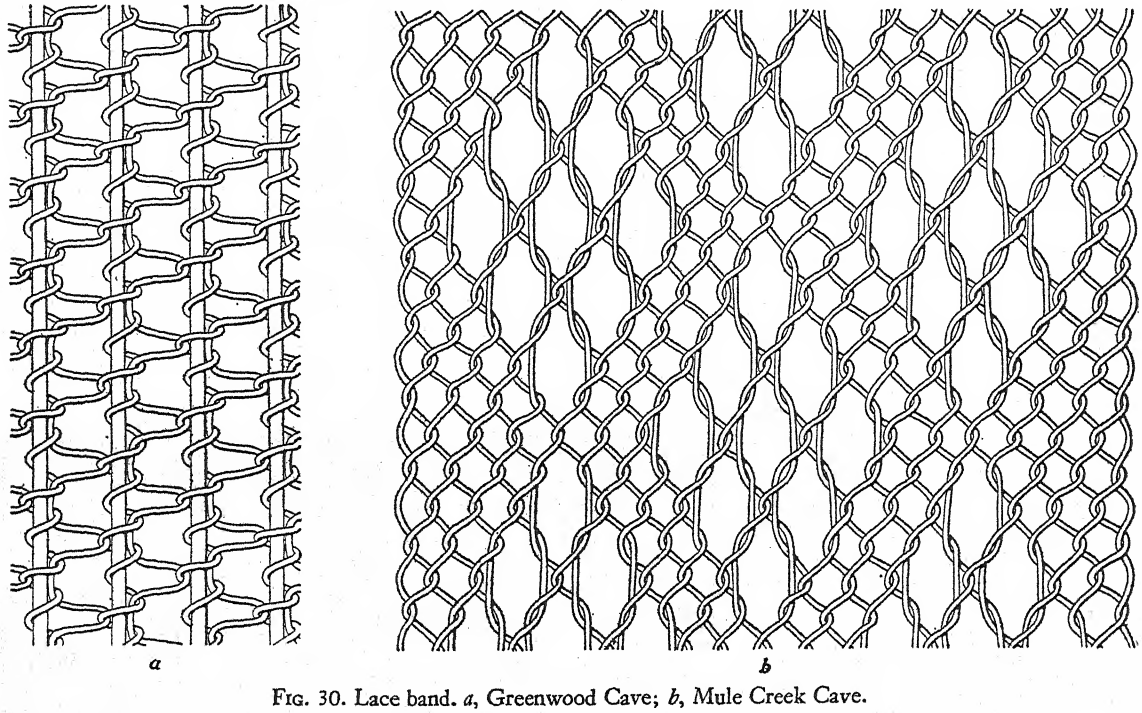


FIG. 30. Lace band. *a*, Greenwood Cave; *b*, Mule Creek Cave.

In the specimen from Greenwood Cave, shown in figure 85, *b* and figure 30, *a*, the fibers are loosely spun right into a strand the size of number 100 cotton thread. The warps are 2 strands doubled, making left-twist cords. The filler between the warps consists of closely waved strands attached to the warps at their bends by a separate thread twined around each warp. Possibly some attempt may have been made to enrich the lace with a design, for 1 frayed edge shows the use of heavier looped strands.

The lace band from Mule Creek Cave shown on figure 86, *e* and figure 30, *b* is made of 36 right-spun strands approximately the size of number 8 cotton thread. The process consisted of suspending the series of threads, and by interlocking them, making a netted fabric in which at regular intervals opposed threads picked up 2 loops on each side instead of 1 loop to draw them farther apart and to form in a band 3 rows of latticed diamonds. The specimen is 11 inches long and 1 inch wide.

Weft-wrap Openwork[9] (figs. 31; 86, *a–d*)

Source and Quantity. Upper Gila area—Doolittle Cave, 1 specimen; Mule Creek Cave, 1 specimen.

Technique, Doolittle Cave Specimen (fig. 86, *c*). This is of 1-ply soft-twist cotton, warp and weft threads twisted left. No difference can be seen in weights of these strands, which are of unevenly spun thread, the size of 8 to 24 cotton. The body of the textile is of plain over-1-under-1 weave, 24 warps and 20 wefts to the inch. An ornamental design (fig. 31, *a*) was worked into the fabric in the upward weaving by taking the fourth weft, giving it 3 turns around the preceding 3 wefts (1), then under and over the next 4 warps and twice

[9] Designation follows that adopted by Haury, 1934, p. 91.

around these warps (2), repeating this operation as often as desired through the pattern. After being laid in as a plain weave, the next 3 wefts and the same set of warps were wrapped by the next weft, as before, to complete a series of square openings in the cloth, each with a tight triple-wrap spindle at top and bottom and a double-wrap spindle on one or both sides. At the angles in the plain weave adjacent to the ornamental work, 1 edge was bound with 2 warps which previously had been twined as the wefts passed through them (3); and on the other edge a weft, after passing through and encircling sets of warps to form wrap-spindles in another series of openings, was threaded under the preceding weft (4), so that the openings bordering the plain weave were not contracted by the tension of the encircling wefts. The frayed specimen (5 inches long and 1 1/2 inches wide) gives no idea as to the opposed edgings or as to the completed design. All that can be seen is that the junction of the decorative field and the plain cloth forms a stepped line.

Technique, Mule Creek Cave Specimen (figs. 31, *b;* 86, *a, b, d*). This is of 1-ply medium-hard twist cotton warp and weft threads, twisted left. The unevenly spun threads averaging the size of 24 cotton, while some are as fine as 50 cotton thread; no difference can be seen in the weight of warp and weft strands. The body is of plain cloth, over-1-under-1 weave, 28 warps and wefts to the inch. Possibly the variation in size of threads is due not alone to uneven spinning but to the resultant twisting and additional tension given the threads as they were wrapped around the warps and wefts. It is evident that a finished design was conceived and kept in mind throughout the upward hand-weaving process. As seen in figure 86, *a* and *b*, in the detailed drawing (fig. 31, *b*), weft 3 spread pairs of warps by coiling twice around each one and under the preceding weft. In the next course weft 4 encircled the same warps and, in its turn, weft 5 was looped around weft 4 between these warps to complete the round openings in the plain cloth. The lower tier of warp-spindles (fig. 31, *c–e*) was made by coiling weft 4 around pairs of warps, at the same time encompassing weft 3. At the selvage weft 4 became weft 5, and with pairs of warps was in turn incorporated in the bundles of warps wound by weft 6 (*f–h*). This set of spindles was placed 1 warp space to the right of the lower set (*c–e*).

While the formation of the round openings in the cloth did not affect the direction of warps and wefts, this was not the case with the more or less square openings, since both warps and wefts were pulled obliquely and waved by the courses of weft wrapping.

Originally the specimen was a flat piece, estimated in its torn condition to have been 8 inches wide. The length cannot even be approximated. The sides of the cloth, with non-reinforced selvage on the edges, had been sewed together with a whipping of cotton thread to form a cylinder. At 1 end is the remains of an edging cord, the 2 strands of which were twined through the looped warps (fig. 31, *i*). It cannot be stated whether the opposite end of the cylindrical piece of fabric was likewise reinforced.

We have duplicated a section of this ornamental cloth (fig. 86, *a*), and because of the fine stitches required, have demonstrated that the warps had to be strung on a frame and that only a needle could have been used to thread wefts through and around them. No slender bone needles were found in any of the caves investigated. Only 1 yucca spine needle was recovered (Ceremonial Cave in the Hueco Mountains), shown in figure 139, *c*. However, Haury obtained a number at Canyon Creek Ruin, where a sample of weft-wrap openwork was unearthed, so that it is probable that such needles were used for delicate work.[10]

As evidence that cotton threads were attached to yucca spines, Morris illustrates such a needle from Aztec Ruin, with cotton twisted into the separated yucca fibers below the thorny point.[11]

There is no evidence that the threads in this specimen were colored, nor would it be necessary in such an elaborately woven textile. When viewed vertically or horizontally the design, which is the result of the openwork technique, consists of alternate rows of diamond-shaped figures filled with dots or interlocked frets; when seen diagonally, these figures alternate in each row.

In its original state the small diameter of this cylindrical piece of fancywork almost precludes its use as a wristlet or sleeve, yet it might have been part of a garment for a very small infant.

Reference has been made to the Haury find of weft-wrap openwork at Canyon Creek Ruin. In the same report he cites specimens in the Arizona State Museum from Nitsi Canyon, northern Arizona, and from Camp Verde and the Tonto National Monument, west of the Canyon Creek

[10] Haury, 1934, pl. LV, *b*.

[11] Morris, 1917, p. 172.

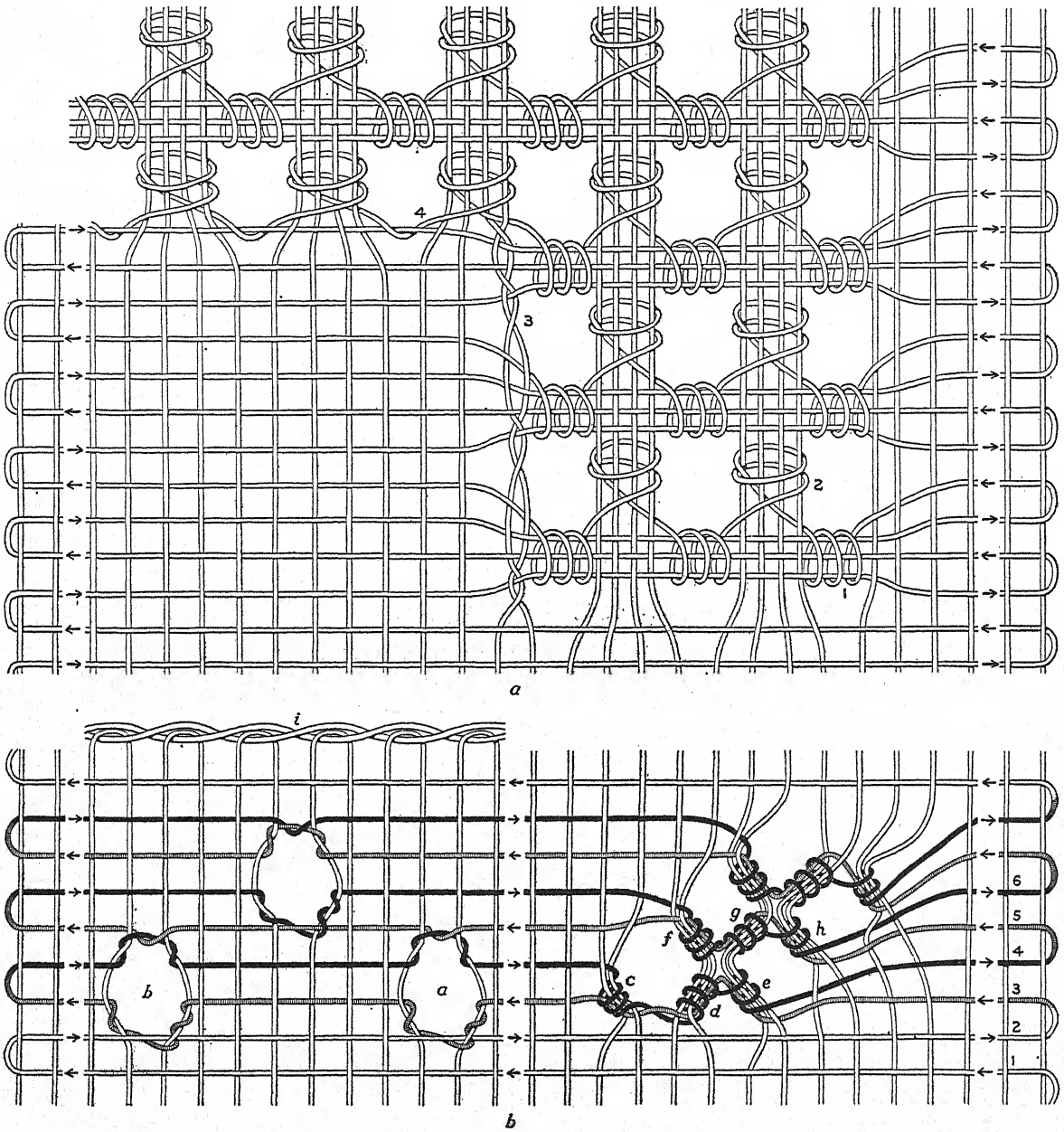


FIG. 31. Weft-wrap openwork. *a*, Doolittle Cave; *b*, Mule Creek Cave.

Cave.[12] Another specimen from the Verde River district, in possession of William H. Claflin, Jr., came from the tributary Clear Creek. Hough figures such cloth found by Fewkes at Casa Grande and several pieces which he himself found in Bear Cave on the Blue River tributary to the San Francisco in extreme eastern Arizona.[13] The elaborate piece from Mule Creek Cave also in the San Francisco drainage, and the one from Doolittle Cave, Mimbres Valley, extend the distribution of weft-wrap technique well into New Mexico and toward the south. When the reported examples

[12] Haury, 1934, pp. 91–95.

[13] Hough, 1914, pp. 77–79.

of this work are compared, they are found to be much the same—rectilinear patterns with nearly duplicate manipulation of weft threads in the cloth from Canyon Creek of the Sierra Ancha and in that from Doolittle Cave in the Mimbres. The 1 exception, and an outstanding and extremely beautiful example, is the piece from Mule Creek Cave, which though partially conforming to the rectilinear, includes a diagonal pattern not dependent on oblique steps across the warps.

Haury, by tree-ring dating, definitely places the Canyon Creek example in Pueblo IV. If dated by pottery, our specimen from Mule Creek Cave is earlier in the Pueblo series (early III or possibly II), since Mimbres Bold-face Black-on-white sherds and 1 complete bowl came from this place. The specimen from Doolittle Cave can confidently be placed as Pueblo III as nothing but Mimbres Classic Black-on-white pottery was found there.

Textile Conclusions. Under the head of textiles are grouped clothing and other woven objects of different materials and uses.

First to be considered are fur-string blankets, found in both the Upper Gila and Hueco areas and, as mentioned, used by the Pueblo and without question by the Basket-maker inhabitants. In all periods these garments were more or less standardized, the only variation noted, which may or may not prove significant, being that generally in the Hueco area the strips of fur-covered hide were not reinforced by a string core.

Although the major remains in the Upper Gila were Puebloan, feather cloth, which is allocated to that culture, is very scarce, only 1 piece of feathered warp and parts of a decayed blanket around a Pueblo burial having been found. However, there is no question that blankets and shaped garments of this material were used by the Pueblo, since Hough collected not alone scraps of feather cloth but also a complete jacket from the Tularosa Cave in the Upper Gila area.[14] Our investigations in the Hueco area show the use of feathers for ornamental purposes rather than for clothing. As far as can be ascertained, the same is true in the Guadalupe, lower Pecos, and Big Bend areas.

String aprons are not well represented in the collection, but others have found specimens in the Upper Gila, Hueco, and Big Bend areas. Hough, in illustrating a feather-cord jacket from Tularosa Cave on the San Francisco, shows the remains of a "pink"-dyed cord "loin band" attached to the jacket. From Bear Creek Cave in the same district, he shows 2 red and black-dyed string aprons (called by him "costume pahos") held together at the center like those just described.[15] Roberts shows an apron from Ceremonial Cave in the Huecos, which is now in the R. B. Alves collection.[16] Martin figures a string apron from the Shumla Caves on the Rio Grande, near the mouth of the Pecos River.[17] This specimen is larger but similar to the one from Ceremonial Cave figured by Roberts.

The apron from the Huecos and that figured by Martin conform more to the northern type since they are made by looping clusters of strings over a waist cord, while those from the upper Gila are heavy skeins of cordage with a binding at the center through which the waist cord passes.

The specimens in figure 78 all came from 1 site on the Upper Gila, and it is peculiar that more were not uncovered, since other investigators have found many throughout the Southwest in early and late sites.

The cotton used in one of our specimens indicates that it was part of a Pueblo Indian costume. Whether the other examples are of an earlier period is not known.

Plain-woven cotton cloth bespeaks a Pueblo product, both in the form of blankets and for use in other ways. No cotton textiles came from the Hueco area; the Upper Gila furnished a few specimens. When the examples of plain-woven cotton fabrics from the Upper Gila are compared with those from Pueblo ruins to the north and west, it is found that the spinning, number of threads to the inch, weights of cloth, and selvage treatment are the same. The braided corner tassel on 1 specimen (p. 69; fig. 79, *b*) compared favorably with a like technique seen on cotton blankets from the Gila-Salado area of Arizona. The sleeve-shaped cotton quiver (p. 69; fig. 79, *a*), as mentioned, is also reminiscent of that region and of its Pueblo occupation.

The few examples of twined weaving shown in fragments and in 1 complete bag, described under that heading, are probably not inclusive, and others may yet turn up. Our present knowledge of twined weaving in the Upper Gila and

[14] Hough, 1914, figs. 148 and 149.
[15] Hough, 1914, figs. 149 and 150; pl. 23.
[16] Roberts, 1929, fig. 1, pl. 4.
[17] Martin, 1933b, pl. XLIV, no. 5.

Hueco areas is confined to bags. The same appears to be true of the Big Bend area, a circumstance which suggests that the knowledge of the Coahuila, Mexico, twined-woven cloth in the form of blankets with buttonhole selvage did not pass the Rio Grande into that area. Technically the weaving of the Upper Gila and Hueco bags is well done, and the method of inserting additional warps to increase the size is the same as that used in bags made by the San Juan Basket-makers. Comparison of the decoration on San Juan bags with those from this area and with specimens found farther south by others shows that there is less variety, and the banded designs are generally less elaborate in the southern area. Another variation is that the colors were from dyes rather than pigment rubbed into the thread as occurs in northern Arizona.

Before the introduction of cotton, twined weaving, with but a few possible exceptions, was confined to the use of yucca fiber in all districts of the Southwest. This is proved by its association with pre-Pueblo specimens in the Upper Gila and Hueco areas as it has been in the San Juan.

Twined-woven bags have been recovered in the Guadalupe Mountains. Howard mentions a fragment with red decoration from the southern point of this range in Texas,[18] and on the eastern slope at Burnet Cave, Three Forks country, he found with a burial an excellent complete specimen made of yucca-fiber cord woven alternately red and white with several bands of black and yellowish lines.[19] In a more recent report Howard mentions 2 other graves in the same cave that contained fragments of twined-woven bags.[20] In the Chisos Mountains of the Big Bend Setzler found "painted twined-woven bag" fragments but does not mention the material used.[21]

Although examples of the Basket-maker twined-weaving technique are not numerous, yet specimens from the Upper Gila, Mimbres, Hueco, Guadalupe, and Big Bend areas are links in a chain extending well to the south.

Four types of coiled netting (pp. 71–72) appeared in this collection; plain, full-turn, knotted, and coiled netting on warps. The plain coiled netting is represented by a large bag from the Hueco area; the full-turn coiled netting technique in the Upper Gila and Hueco areas shows up only in the coarse yucca-leaf carrying nets, although, as will be noted, appearing farther south in a softer cordage. The knotted coiled netting fragments from Ceremonial Cave in the Hueco Mountains are another variation, and the fragments of coiled netting on warps, from Steamboat Cave in the Upper Gila, seem to presage a step from finger weaving to that on a loom.

As to the simpler types, Kidder and Guernsey show specimens of plain coiled netting from Pueblo sites in the Kayenta region.[22] They also describe a sack from White Dog Cave, a Basket-maker site in the same region. The weave is unusual in that a continuous cord (sections spliced and not joined by knots) was colored at intervals to make a red bottom, and red and brown stripes near the top.[23] South of the Upper Gila-Hueco area Martin, at Shumla Caves in the lower Pecos River region, discovered the weave in both plain and full-turn loop, stating that the former technique predominated.[24] Coffin describes both types of weave in bags from Bee Cave in the Big Bend.[25]

Regarding the knotted coiled netting in yucca leaves, such as were found at Ceremonial Cave in the Hueco Mountains, Coffin reports a similar piece from Bee Cave in Brewster County, Texas.[26] As to the same weave in cordage, Guernsey illustrates a specimen from Cave 1, Segi Canyon, northeastern Arizona, and he calls attention to this weave as appearing for the first time in the Basket-maker III period.[27] The specimens from the Huecos and from Brewster County, Texas, bespeak the early use of this technique outside of the San Juan area.

Thus it can be seen that coiled-netted bags were manufactured as far north as southern Colorado and Utah. The stitch appears in carrying nets in the Upper Gila and in bags in the Huecos and on down the Rio Grande in west Texas, where in the latter area we are beginning to see that such bags were more common, taking the place of twined bags, though not necessarily subsequent to them.

The plain coiled bag from Chavez Cave cor-

[18] Howard, 1930, pl. XXVIII, no. 1.
[19] Howard, 1932a, p. 11; pl. 2.
[20] Howard, 1935, pp. 67–68.
[21] Setzler, 1932, fig. 56, *e*,
[22] Kidder and Guernsey, 1919, pls. 34, *a* and *b;* 40, *a;* 46, *c;* p. 117.
[23] Guernsey and Kidder, 1921, pl. 25, *d;* p. 77.
[24] Martin, 1933b, pls. XLIV, no. 1; XIV, nos. 1 and 2; p. 48.
[25] Coffin, 1932, p. 41.
[26] Coffin, 1932, pl. XIII; p. 41.
[27] Guernsey, 1931, pls. 46, *e;* 54, *b;* p. 79.

responds in period to the one from the Basket-maker site (White Dog Cave) found by Guernsey and Kidder; the practice of knotting loops in netting is shown by Guernsey to have occurred in Basket-maker III times. So far as we know, coiled netting on warps is unique, first impressions being that it is a twined weave. The association of the specimens in rubbish that gave up Basket-maker artifacts and near storage and sleeping cists suggests a variant in coiled netting applicable to that period. Dry color rubbed into the cordage is also reminiscent of a Basket-maker practice in their twined weaving.

No doubt there are other specimens extant of the various types of coiled netting, but these references serve to show both Basket-maker and Pueblo usage and a spread of the technique into other areas.

Among the narrow fabrics can be identified headbands, burden straps, sashes, and other ribbon-like textiles which could have been used in various ways.

One complete yucca-fiber headband from the Upper Gila, described on page 73, is analogous to Basket-maker III type showing a decorative weave though not as elaborate as of those of that period. Fragments of plain-woven yucca-fiber headbands from the same region are thought to be earlier, since Guernsey and Kidder found similar ones attached to carrying baskets in the Basket-maker site White Dog Cave.[28] The numerous pieces of heavy yucca or bear-grass burden straps found with the coarse coiled-netted carrying nets can be placed in all periods. Narrow braids of coarse and finer yucca cord join the same category, being of questionable usage. Included with these are twilled bands of yucca from the Hueco area, while from the Upper Gila, indicating a Pueblo product, are cotton bands woven in the same way.

Two more items in narrow fabrics from the Hueco area appear in the collection. For lack of a better name, the technique in one has been termed "spirally wrapped warps" and in the other, "zigzag twined weft." Both are woven with yucca-fiber cords; the first method is simplicity itself yet produces an extremely attractive tape. Pieces of this weave were found at 2 sites, Chavez Cave on the Rio Grande and Ceremonial Cave in the Hueco Mountains. Interest lies in the wider fragments in the spirally wrapped warp technique from Ceremonial Cave since, as previously mentioned, they were in a Hueco Basket-maker grave and must necessarily represent an early weave. The wide belt fragment with zigzag twined weft, also from Ceremonial Cave, is unusual and must be ancient as it came from a predominately pre-Pueblo site.

The fragments of cotton lace and the pieces of weft-wrap openwork from the Upper Gila represent the culmination of needlework for Pueblo art, the latter technique seeming to be a link tying the Upper Gila Pueblo with those who drifted from the north into the Gila-Salado area.

Checking the number of netting fragments, it is seen that yucca fiber was the principal material and that in the Hueco area and to the south nets for various purposes were more common. It might be suggested that more nets were used for rabbit drives in the latter areas. However, it can be seen that their adoption was practical for fishing in the silty waters of the Rio Grande, while in the mountain streams, one would have poor luck in trying to capture trout with a dip-net or seines.

Quantities of string fragments from all sites may be allocated to both early and late periods. The principal material was yucca fiber, and, in later times, the introduction of cotton, which could be spun into softer and finer threads.

Animal hair was used to a limited extent, and also human hair, which does not seem to be diagnostic of the early cultures in the Upper Gila-Hueco-Big Bend, as it is in the San Juan.

[28] Guernsey and Kidder, 1921, p. 75; pl. 23, *k*, *l*.

SANDALS

IN SUCH a country—one of gravel, sharp rocks, and thorns—protection of the feet is necessary. No matter how toughened the prehistoric people living here had become from walking unshod around their camps, there is no doubt that they would have become footsore when it was necessary to take long journeys through the mountains in search of game, to communicate with distant peoples, or to visit their cave shrines in the cliffs. Apparently the difficulty of killing deer and antelope with primitive weapons resulted in a limited supply of skins; the latter were considered more valuable for body covering than for tanning as leather and cutting up for sandals or moccasins. This theory is borne out by the complete absence of such footwear in the numerous rock shelters and caves in the area.[1] In view of the probable scarcity of leather some substitute had to be found, and the ever-present varieties of yucca solved the problem. The leaves and fiber from this plant furnished the material for the sandal treads and, in the softer sandals, cords for both warp and ties. The varied lengths of leaves obtainable and the ease with which they could be split into strips and partially softened when used in clusters or worked into fibrous strands for knotting were no doubt soon realized. The tough fiber, when green and pliable, lent itself to sharp turns and tight knots without breaking.

Taken as a whole, the sandals under discussion appear to be coarse and crudely made, but experimentation shows that a certain amount of skill was necessary to manufacture them. Although the average person in those days could probably make a pair of sandals very quickly, he could accomplish this only by profiting from the experience of his predecessors who, over a long period, had developed numbers of ingenious tricks of weaving. Often many interesting variations in weaves were not discovered until the sandals were closely studied and some of them dissected in order to follow the course of the yucca leaves or shredded strands.

The diagrammatic drawings, though in some cases not showing in outline the variety of sandal shapes in a given category, are intended primarily to illustrate the method of handling the elements, weaving them together, and to draw attention to the features that are concealed in the body of the finished product. In toe and full-length sandals 14 general types were detected. Reference to the photographs of sandals will give an idea of their appearance, so that like specimens may be recognized if found in other localities. It is hoped that the illustrations showing technique and the subdivisions into types as herein adapted will be of further assistance as research continues. (See p. 93.)

Type 1*a*, Four-warp Short Scuffer Toe Sandal (figs. 87, 88)

Quantity. One hundred and twelve specimens sufficiently complete to measure.

Warp. Four warps of 2, 3, and 4 whole yucca leaves; outside warps tied together at the toe with a square knot; intermediate sets of warps fastened at the toe by wrapping around the outer warps, then crossing back over themselves, with their ends caught between the outer warp elements; broad ends of leaves composing sets of warps prevented the weft from sliding off at the tail of the sandal.

Weft. Two to 4 leaves, all shredded except at the large end; small percentage of sandals with unshredded leaf wefts.

Weave. The weave is a close wickerwork (plain over-and-under) starting at the tail. The large ends of the leaves composing the wefts protrude on the under side to break up with wear and form a pad. The warp butts turn down at the tail of the sandal instead of up, as would seem natural. The compact upper surface with a loose softer fill on the tread may account for this.

Toe Loop and Side Straps. These are of 2 sets of double, triple, or quadruple yucca leaves. A shredded wisp from each cluster of large ends is tied with a square knot to the frayed weft ends

[1] Since the above was written, a pair of flat leather sandals, 8 inches long, and a 6-inch leather sandal have been found in Kelly Cave on the San Francisco by a collector, R. C. Eisele. However, a cache of navy beans stored in a Pima-like basket (likewise found by Eisele in the same cave) strongly suggests that these sandals are of late Apache make and therefore did not belong to the earlier Pueblo occupants who made the yucca-fiber sandals found there.

at the toe on the under side of the sandal. Each set passes up through the bottom of the sandal behind the toe selvage and between the elements of the 2 middle warps. They are then crossed as a preliminary step in forming a toe loop. From this point they become side straps extending out around the side warps midway of the ball of the foot and back to their initial intersection. Here the ends pass around the crossed strands and are tied off with a square knot to complete the toe loop. Cross strands of the toe loop confined by this knot have play, and when a lift or pull occurs on the side straps the loop is tightened around the toe. In specimens from Chavez Cave there occurs a variation consisting of the attachment of additional side-strap leaves, the butt ends of which are held by the wefts and emerge from the sides of the sandal somewhat farther back on the sole. In this case the extra side straps form a large ball where their shredded ends are tied with a square knot to the toe loop.

Size. The extreme widths are 2 and 4 1/2 inches; small (2 to 2 3/4 inches wide), 7 per cent; medium (3 to 3 1/2 inches wide), 65 per cent; large (3 3/4 to 4 1/2 inches wide), 28 per cent. Extremes in length are 3 1/2 to 7 inches; 70 per cent of sandals, 1 to 2 inches longer than their width.

The toe loop usually accommodates only the second toe; a few instances occur in which the loop is large enough for both second and third toes. There are no lefts or rights, as the toe loop is always at the center. One exception to this general rule is found in a sandal for the right foot with a loop to engage the great toe.

These sandals are broad, at the toe, narrowing considerably to the termination under the instep.

Type 1*b*, Four-warp Half-sole Scuffer Toe Sandal (figs. 87, 88)

Quantity. Nineteen specimens sufficiently complete to measure.

Warp. Same as in Type 1*a*.

Weft. Same as in Type 1*a*.

Weave. Same as in Type 1*a*.

Toe Loop and Side Straps. Same as in Type 1*a*.

Size. Equally divided into 3 to 3 1/4, 3 1/2 to 3 3/4, and 4-inch widths; division nearly equal into 6, 6 1/2, 7, 7 1/2, and 8-inch lengths.

This sandal differs from Type 1*a* by being more uniform in width throughout, with only a slight narrowing at the tail. This generally necessitated tying together parts of the broad warp ends to prevent the wefts from slipping off. The greater length of Type 1*b* gives it a different appearance, yet structurally it falls in the same category as Type 1*a*. This type is more like a half-sole and gives greater protection to the foot.

Type 1*c*, Four-warp Short Scuffer Toe Sandal (figs. 87, 88)

Quantity. Three specimens.

Warp. Four warps of 3 whole yucca leaves each, with broad ends of leaves at the tail.

Weft. Shredded leaves.

Weave. As a preliminary to weaving the tread, the sets of warps at the tail are halved and bound together with strips of yucca woven over-and-under, causing the bundles of warps to cross each other. These warps are then divided into 4 sets, around which the shredded weft leaves are tightly packed in close wickerwork, while weft ends protrude on the under side to form a wearing pad. As the weaving progresses, a set of leaves with butts at the sandal toe is laid along each inner warp. The ends of these sets cross over to the outer warps and are held in place by the wefts as they come out on either side of the sandal for side straps. At the toe the 2 twisted inner warp sets are turned on each other, pass around the butts of the side-strap leaves, and are joined with a square knot on the under side of the tread.

Toe Loop and Side Straps. To form the toe loop, each twisted outer warp strand passes through the loop of inner warps around the ends of the side-strap leaves. The toe loop and side straps are joined and knotted as illustrated (fig. 88, 1*c*). The tapering ends of 5 whole leaves making up side straps are shown as 1 leaf in the drawing. The centered toe loop allows the sandal to be used on either foot.

Size. The width is 3 3/4 inches; length, 7 inches.

Shape. These sandals are obovate, with a fish-tail effect at the end.

Type 2, Two-warp Scuffer Toe Sandal (figs. 87, 88)

Quantity. Twenty-four specimens sufficiently complete for measurements.

Warp. Two warps of 2 to 6 whole yucca leaves with large ends toward the rear; small ends of warp sets are joined by a square knot at the toe (subtypes 2*a* and 2*b*); warp strands at the toe of subtype 2*c* are tied with a single knot on either side of their final junction in a square knot; method of joining warp strands equally divided between the grouped subtypes, 2*a* and 2*b*, and subtype 2*c*. With only 2 exceptions, parts of the rear ends of the warp are teased out and tied with a square knot to prevent the weft from sliding off at the tail.

Weft. Two to 4 whole leaves with the large ends protruding on the under side of the sandal for a pad.

Weave. The weave starts at the tail and progresses in close wickerwork.

Toe Loops and Side Straps. These are sets of 1 to 5 whole leaves for each side, with the large ends protruding on the underside of the sandal at the toe. The leaves are threaded between warp strands at the toe. They cross each other, then extend out and around the warp at the ball of the foot, and back again, with the ends tied in a square knot at their initial crossing to complete the toe loop and side straps. This method is identical with that used in the Type 1 sandal. The large flared ends are utilized, as at 2*c*, to prevent the leaves from pulling out from between the warp strands, or are joined in a single knot, 2*a*, to make them more secure, or are divided and tied separately as at 2*b*. The toe loop in some specimens is made for only the first toe, although most of them are large enough for both the first and second toes.

Size. Widths are 2 1/2 to 4 inches (majority, 3 to 3 3/4 inches); lengths, 6 to 9 inches.

In outline these resemble the Type 3 sandal series, giving protection to at least two-thirds of the foot and are closely related by the toe and strap fastening to the four-warp Type 1 sandal. The toe loop, situated at the center, allows the sandal to be used on either foot.

Type 3, Two-warp Scuffer Toe Sandal (figs. 87, 88). This classification is based on the manipulation of warps to form the toe loop.

Quantity. Two hundred and thirty-four specimens sufficiently complete for measurements.

Warps. Two warps of 2 to 6 narrow whole yucca leaves (majority, 3 or 4 leaves), all with large ends toward the rear of the sandal.

Weft. One to 4 whole leaves with the butts of the leaves protruding on under side to form a pad.

Weave. The weave, which starts at the tail, is a close wickerwork. The small ends of the leaves are usually caught and concealed under the cross strands.

Toe Loop. At the toe of the sandal, the paired, or multiple, warp strands are divided. One long strand from each side is drawn toward the center and the two are twisted together. Each loose end of this twist engages the opposite free warp strand in a single knot, and the pairs thus formed are brought into a circle of the desired size and tied together with a square knot to complete the toe loop, as in figure 88, 3*a*. These toe loops vary in size, some being for only the second toe, and others large enough for both second and third toes. The loop, placed at the center of the sandal, allows use on either foot.

Side Straps. Single, selected, long leaves or sets of 3 to 5 of the same are crossed over the instep and then tied into the toe loop with a square knot. If a single leaf or single set of leaves is used, it is looped around the tread under the ball of the foot, as in 3*a*, where it is held in place and protected by the over-lapping broad ends of weft leaves; or, as in 3*b*, it is threaded through opposite warp elements. In 3*c–e* 2 single leaves or 2 sets of leaves are used: they are brought up from the bottom, passed around warp strands, and threaded through warp elements on the opposite side of the sandal; in 3*d* they are wrapped around the warp on either side, with broad ends left on the bottom of the sandal; in 3*e*, they pass down through the sandal tread and around the outside of the warps, the butts forming a pad on the top of the sandal.

Size and Tail Finish. In 54 specimens the tail finish is as shown in 3*f*. These differ from the others in that the warps at the end are wider spaced and require the tying together of wisps of opposed warp elements (always with a square knot) to hold the weft in place. Occasionally there were 2 such knots at the end of a sandal. This produces a somewhat less pointed tail and the warps are more nearly parallel. The appearance is that of a half-sole. Extremes in width for these sandals are 2 1/2 to 4 inches (majority, 2 1/2 and 3 inches); extremes in length, 4 to 8 inches (majority, 6 to 7 inches). The length of the shoes and the wear at the ends indicate that there was no protection for the wearer's heel. Some of the sandals were probably full length for chil-

dren. The tail finish of 102 specimens is illustrated in 3*g*. The tail was narrowed by drawing the warps close together with a tightening of the weft strands. The flare of the large ends of the warp leaves prevents the weft from sliding off. This form is best seen by reference to the drawing. In these, extremes in widths vary from 1 1/2 to 4 inches (majority, 2 1/2 and 2 3/4 inches); extremes in length, 3 1/2 to 8 inches (majority, 6 to 7 inches). Sizes of 1 1/2 by 3 1/2 inches to 4 by 8 inches indicate infant to adult shoes. The general run of these sandals is narrower than the 3*f* subtype. The tail finish of 78 specimens is shown in 3*h*. This subtype has the same tightly woven end as in 3*g*. However, an additional wrapping of the last weft strand 1 to 3 times around the tail makes it more secure and has a tendency to force the warp ends to cross each other. Extremes in width of these sandals are 1 1/4 to 3 1/2 inches (majority, 2 to 2 1/2 inches); extremes in length 3 1/2 to 8 inches (majority, 4 1/2 to 5 1/2 inches). With only a few exceptions, most of the sandals in this subtype are smaller than the other 2 and seem to be children's sizes with more care taken in their construction.

With 1 exception, there were no fastenings to the ankle or heel in the Type 3 sandals. This exception was on an infant's sandal 2 1/2 inches wide and 4 inches long, in which the ends of the warp strands on either side were braided and brought together with a square knot to make a toe loop, after which they were passed around the ankle and tied off at the back with another square knot (fig. 87). This diminutive sandal did not have the usual side straps.

Type 4*a*, Two-warp Fish-tail Scuffer Toe Sandal (figs. 89, 90)

Quantity. Fourteen specimens sufficiently complete to measure.

Warp. Two large bundles of 20 to 25 whole yucca leaves loosely twisted together; about one-third of the leaves on either side reversed so that the large ends extend beyond the toe of the sandal; the other two-thirds of each warp bundle, with large ends of leaves toward the rear, composed of leaves of uniform length, combined with a few selected ones considerably longer.

Weft. Loose bundles of whole leaves.

Weave. Wickerwork, very coarse and soft, starts at the heel. The large ends of the leaves protrude on the under side to form a pad. Commonly the flaring butt ends of the leaves making up the warp bundles prevent the weft from slipping off at the end. However, occasionally a few strands from the opposing warps are tied together with a square knot to make the end finish more secure.

Toe Loop. Identical with that of the Type 3 sandal, save that elements composing it are long, selected warp strands from either side. The loop is usually large enough for both the second and third toes.

Side Straps. The reversed (i.e., forward-pointing) bundles of warp leaves are held by the weft as far back as the ball of the foot, where they are released to cross each other over the instep and are fastened to the toe loop with a square knot. The large ends of these leaves become shredded and make a protective toe fringe or bumper. In one of these sandals the toe-loop strands are twisted and the side straps are braided, while in another, both the toe and side-strap strands are twisted.

Size. The width at the toe of measurable specimens is from 3 1/4 to 4 1/2 inches. Two-thirds of these are 4 inches wide. The length varies from 6 to 11 inches. Half of the sandals are 8 inches long.

The shape of the tread is best illustrated by reference to the plates. The width and length of this soft woven sandal furnished protection well behind the instep. The exceptionally long 11-inch specimen (4*a*) appears to be full length, yet it is of the same type as the others since it has no heel fastenings.

Type 4*b*, Two-warp Fish-tail Toe Sandal (figs. 89, 90)

Quantity. Twenty-six specimens sufficiently complete for measurements.

Warp. Two warps of 8 to 14 whole yucca leaves, occasionally reversed half-and-half; usually two-thirds of the leaves with a large end toward the rear.

Weft. Bundles of 6 to 8 whole yucca leaves.

Weave. The weave starts at the tail in rather tight wickerwork weave, the large ends of the leaves protruding on the under side of the sole. The weft strands are laid more carefully at the tail and drawn tightly so that they cannot slide

over the broad ends of the warp leaves Occasionally the ends of the warps are tied in a square knot to hold the weft strands.

Toe Loop. The small ends of warp strands are drawn together into a single knot and the toe loop completed by tying the ends into a square knot. The loop is large enough for only the second toe.

Side Straps. The side straps are made of the reversed warp leaf bundles on either side with the butts of these leaves forming the toe fringe, while the small ends emerge from the selvage at the ball of the foot, cross each other, and are tied to the toe loop with a square knot as in Type 4*a*.

Size. The widths are 3, 3 1/2, and 4 inches; lengths, 5 to 7 inches (majority, 6 to 6 1/2 inches long).

Shape. This type of sandal is obovate, having an entirely different outline from Type 4*a*, yet made up in much the same manner. The tread is not formed for the right or left foot, and the toe loop at the center swings to accommodate either foot.

Type 5, Two-warp Fish-tail Scuffer Toe Sandal (figs. 89, 90). Subtypes 5*a* to 5*f* of this type are based on variations in the technique of weaving (5*d* and 5*f* not illustrated, exhibit only slight differences—brought out in the text—from 5*c* and 5*e*, respectively).

Quantity. One hundred and eighty-four specimens sufficiently complete for measurements, a great number too fragmentary.

Warp. Two bundles of 3 to 8 slender whole yucca leaves with large ends toward rear.

Weft. Single leaves, sets of 2; occasionally sets of 3.

Weave. The work begins at the tail (with the butts of the leaves toward the rear) with wefts in tight wickerwork over and around the 2 warp bundles. Commonly the first weft is a single leaf which is placed just above the flare ends of the warp leaves, drawing them close together by over-and-under weaving. The large end of this leaf is secured under the weave and protrudes at 1 side, as seen in 5*b*. Occasionally this single weft leaf is wrapped 2 or 3 times around the warps, the large end of the leaf coming out between the warp bundles as part of the tail (5*a*). Both methods draw the warp ends together or across each other to produce the fish-tail. Throughout the length of the sandal the warp bundles are compressed by the tight weave and lie close together, seldom being more than 1 1/2 inches apart. The sandal is made wide enough to protect the foot by the shredded leaf butts extending out from the under side and by the small ends of these leaves on the upper side of the sandal which rest on the shredded butts. The result is that the wrapped warps are entirely concealed between these 2 treads. In all the sandals except Type 5*a* the so-called tension straps, composed of a single leaf, lie on either side on top of the selvage and parallel with the warps. These 2 leaves are reversed, the large ends secured at the toe and the small ends tied together with a square knot below the wefts, near the junction of the warp bundles at the tail (5*b*, 5*c*). Apparently these tension straps not alone hold the wefts tightly together but their pull has a tendency noticeably to curl the compact bundles of warps upward at the toe, giving the frame a characteristic sled-like appearance, as shown in 5*a*, 5 *tread*, 5*b*, 5*c*.

Toe Loops. These are made by tying the ends of extra-long protruding warps together with a square knot. The loop, large enough for only 1 toe, is sometimes softened by twisting and shredding the strands. In subtypes 5*b–f* the sharp upward turn of the warps at the base of the loop would force the toe contained in it much above its companions and would seemingly make it very uncomfortable. In the Type 5*a* sandal, with no tension strap, the tread is level and the toe through the loop is not raised above the others. In all sandals the protruding weft leaves at the toe become shredded and form a pad for the ends of the toes.

Side Straps. These are made of 3 to 18 (majority, 3 to 9) leaves on each side, with the leaf butts secured in the weave near the tail of the sandals. The straps cross each other above the foot and are tied to the toe loop with a square knot. When a great number of the leaves are used, the wide band gives additional protection to the side foot and instep but causes a bulky knot where the straps are fastened to the toe loop. This large knot is sometimes avoided by dividing the strands and tying them to the toe loop in 2 places. There are no heel or instep straps except in one case, an infant's Type 5 sandal, 3 inches long, in which the warp strands crossed for the toe and from there extended around and were tied behind the ankle, while the usual side straps were looped

around these strands and tied in front of the ankle to hold the small shoe in place.

Size. Lengths of frames, obtained by measuring the warp leaves from the base of the toe loop to the end of the sandal tail, furnish extremes of 3 to 8 inches, the majority being 4 1/2 to 6 1/2 inches long. The side fringes of this toe sandal give widths sufficient for the ball of the foot and spread of the toes. The tail could not have extended under the heel; therefore, that part of the foot was unprotected.

Since this sandal is a toe type, the width is out of proportion to the length of the narrow warp frame. This disproportion is due to the extremely long under-tread fringes on the sides and also to the length of the leaf stems resting above the fringe and appearing as a series of long ribs. The photographs better illustrate this phase than the diagrammatic drawings, which are intended primarily to show the weave. As an example, the frame of an infant's sandal is 3 inches long, while the side fringes give it a width of 4 inches. On all sandals the centrally located toe loop allows the sandal to be worn on either foot.

Type 5*a* Sandal (figs. 89, 90)— 26 specimens. As previously stated in the general description of Type 5, the *5a* sandals are without the tension straps and the tread does not rise at the toe. The sandal is generally loosely woven, depending on the pressure of the foot to hold the broad ends of weft leaves in place at the toe, although there are 2 cases in which opposite weft ends had been tied at the base of the toe loop for security. The first weft leaf at the heel usually encircles the warps 2 or 3 times with the broad end of this leaf forming part of the tail. The wide ends of the side-strap leaves protrude upward through the tread on either side and are prevented from pulling out by the weft strands.

Type 5*b* Sandal (figs. 89, 90)—11 specimens. Tension straps lying on top of the warp bundles extend from the toe to the rear end and are joined by a square knot below the weft strands at the tail of the sandal. The broad ends of the side-strap leaves protrude on the under side at the toe. Attachment of these straps to the sandal tread is best illustrated by the drawings.

Type 5*c* Sandal (figs. 89, 90)—29 specimens. Tension straps pass out and over the warps and hold down the broad ends of the side-strap leaves which rise up through the tread of the sandal on either side.

Type 5*d* Sandal (not illustrated)—46 specimens. There are tension straps, handled as in *5c*, but these do not bind down the ends of the side-strap leaves.

Type 5*e* Sandal (figs. 89, 90)—68 specimens. Tension straps cross each other on top of the tread, pass out and around the tail, and are tied together with the regulation square knot on the under side. On either side the tension straps bind down the broad ends of the side-strap leaves rising out of the sandal tread.

Type 5*f* Sandal (not illustrated)— 4 specimens. This is a variation of *5e*, the only difference being that the broad ends of the side-strap leaves are left free and are not bound down by the crossed tension straps.

Combination Type 3+5*a*, Full-length Two-warp Sandal with Heel Loop and Tie Strings (figs. 89, 90)

Quantity. One specimen.

Warp. Two bundles of 3 slender whole yucca leaves with large ends toward the rear.

Weft. Pairs of whole yucca leaves.

Weave. As in Type *5a*, with the small ends of the weft leaves coming out on top of the tread. These trimmed weft leaves, called ribs, extend to the heel of the sandal.

Toe Loop. As in Type 3 (see p. 84).

Heel Loop and Tie Strings. To the rear of the trimmed weft leaves and on either side of the heel, the ends of 2 sets of 4 weft leaves are left long. Each set is joined at the side by an overhand knot, 1 pair extending behind the heel and tied with a square knot to form a heel loop, while the other opposed sets, as tie strings, passing in front of the ankle, are given a half hitch and their ends tied to the toe loop with a square knot.

Size. The width from the ends of the weft elements is 3 3/4 inches; length, 8 1/2 inches.

Type 6, Twilled Scuffer Toe Sandal (figs. 89, 90)

Quantity. One specimen.

Weave. Irregular, oblique twilling for the most part over 3 and under 4. The sandal consists of 48 narrow whole yucca leaves laid with their butts at the toe end of the sandal. The weaving elements are single leaves or 2 leaves, one on top of

the other. Plaiting starts with the broad ends of the leaves, the narrowing of which causes the sandal tread to taper toward the tail. The unsecured ends of plaiting at the toe are bent squarely down under the tread to form the sandal toe, and the ends of 1 or 2 opposite elements emerging at the selvage at the rear end are tied together with a square knot on the under side to prevent the sandal from unraveling at the tail.

Toe Loops. Coarse untwisted shredded fiber strand passed through 4 holes in the tread to form 2 loops, one for the great toe and the other for the second and third toes. The under-folded ends of plaiting elements at the sandal tread prevent wear of the toe-loop strand threaded through the fabric. In the only specimen found, the tying off of 1 end of the toe-loop strand has been destroyed so that this feature cannot be definitely determined.

Size. The width is 3 1/2 inches at the toe and 2 1/4 inches at the tail; length, 9 1/2 inches.

There were apparently no heel loops or tie strings; position of the toe loops indicates use on the right foot.

This rough and apparently hurriedly made sandal was definitely finished off at the tail by tying opposite selvage elements. At that part of the sandal there are no signs of ankle fastenings; this, with the frayed and warn condition of the fabric at the rear end, shows that it was a scuffer sandal sufficiently long to give protection well under the heel.

Type 7, Two-warp Full-length Sandal (figs. 91, 92)

Quantity. Four complete, 2 toe fragments, and 2 tail fragments.

Warp. Two warps of 2 to 4 whole yucca leaves with large ends at the tail; 1 instance of a pair of warp strands bent in a U-shape, with ends at the toe to form the sandal frame.

Weft. Single leaves woven around warps.

Weave. Starts at the heel in an over-and-under weave with the small end of each successive leaf brought to the upper side; protruding butts of these leaves form a pad on the tread. Single opposed warps are twisted together at the toe and are then looped around one of the free warp strands to secure and pull all warp ends down on top of the sandal. The heel of the sandal is wrapped 2 or 3 times with the first weft leaf drawing the warps together as in Type 5, fish-tail sandals. The method of overlaying the weft strands gives a smooth surface and selvage, also a thick tread in addition to the shredded leaf pad on the under side.

Toe Loop. Set back 1 1/2 inches from the toe; formed by fastening together with a square knot 1 or 2 of the opposite weft ends which emerge from the sandal. This loop will take the second and third toes.

Heel Loop and Tie Strings. A single leaf strand is passed through the sandal and secured around the warps on either side with a half hitch to form the heel loop. The ends of this leaf cross over the instep as tie strings and are attached to the toe loop with a square knot.[2]

Size. Widths, 3 1/4 to 3 3/4 inches; lengths, 7, 10, and 11 inches.

This type of sandal has a square toe, parallel edges, and quick taper at the heel. There is nothing in the shape to indicate rights or lefts, and the centered toe loop allows the shoe to be worn on either foot.

Type 8, Two-warp Full-length Sandal (figs. 91, 92)

Quantity. Four specimens.

Warp. Warp on either side, a single *Yucca macrocarpa* leaf.

Weft. Single leaves woven around warps.

Weave. A rough, loose, over-and-under weave starts at the sandal heel. The small ends of the leaves protrude on the upper side, while the butts do the same on the tread to form a pad. The ends of the warp leaves are tied together with a square knot, forming a rounded heel. At the toe, the warp leaves are split, and the opposed strands thus formed are twisted together and tied with a square knot to the free strand on either side.

Toe Loop. One inch from the end, lengths of opposite wefts coming out of the tread are left free and tied together with a square knot to form a loop for the second toe or second and third toes.

Heel Loop and Tie Strings. Manipulation as in Type 7.

Size. The widths range from 2 3/4 to 4 inches; lengths, 6, 7, and 10 inches.

Compared with Type 7 this sandal appears crude and rough, with little regard to shape. This

[2] Method of sandal attachment was determined by remains of ties left on fragments.

may be due to its having been woven from the stiff leaves of the *Yucca macrocarpa* which are not as easily handled as those from the *Yucca elata* used in nearly all other fiber specimens. These sandals, with squared toe, parallel edges, and rounded heel, will take either foot.

Type 9, Full-length Turned-heel Sandals (figs. 91, 92)

Quantity. Seventy-two specimens (28 Type 9*a* and 44 Type 9*b*).

Weave. These sandals are oblique twilled (over-2-under-2) and oblique checker. Whole yucca leaves are used, sometimes softened during the process of plaiting. The weaving starts at the toe, commonly by bending 4 leaves to form 8 elements. In 5 specimens the leaves are narrow and from 14 to 16 elements are used. The loose ends of these braided elements are sometimes secured by a wrapping of fiber tied with a square knot, as in 9*a*. The desired length is attained by turning over the end, which forms a heel pad on top of the tread; while the instep strap attached to the tread binds this heel pad down and prevents the ends from raveling (9*b*) even though they may not be wrapped as in 9*a*.

Toe Loop. In Type 9*a* the toe loop, made of a shredded leaf strand, passes under 1 or 2 of the upper-tread elements, 1 to 1 1/2 inches from the toe. The ends of the loop strand are joined with a square knot.

Instep Straps. For 9*a*, a single shredded strand is threaded through the selvage on either side and holds down the heel pad. The ends of the strap cross as they pass through a bend of the square knot in the toe loop and are tied with a single knot as illustrated. The bend of the square knot in the toe loop assumes the form of a link, and when the ties are drawn taut, the hitch will not slip and is easily loosened for readjustment (9*a*).

The combined toe loop and instep strap in 9*b* is made of a single strand, threaded through the selvage at the heel as in the 9*a* sandal. The ends of this strand cross above the toes. One end is caught under 1 or 2 of the tread elements at the front, and the tips are tied with a square knot at their intersection to complete the toe loop. The tightened knot is seen in 9*b*. The loops for both types of sandals take the second and third toes.

Heel Strap. In 9*a* and 9*b* sandals the heel strap is a single strand looped around the instep straps with the ends tied together in a square knot.

Size. The oblong sandals average 2 1/2 to 3 inches wide and 4 1/2 to 7 inches long; 3 specimens, 7 1/2 to 9 inches long. Most of the tapering sandals are 4 inches wide at the toe and average 3 to 3 1/2 inches wide at the heel; average length, 8 1/2 to 10 inches; 2 specimens, 10 1/2 to 11 inches long.

Children's sandals are oblong in form with square heels and the corners of the straight toes slightly rounded. Adult, or large tapering sandals, have square heels; some have square toes and others show a slight rounding. The large tapering sandals are 1/2 an inch to 1 inch narrower at the heels than at the toes. The centered toe loop allows the shoe to be used on either foot.

In these sandals there is nothing to protect the weave on the under side as no leaf ends protrude to form a pad as in the fish-tail varieties.

Type 10, Two-warp Scuffer Toe Sandal (figs. 91, 92)

Quantity. Six specimens, sufficiently complete for measurements; 3 fragments.

Warp. Two wide yucca leaves laid on top of each other and turned up in a U-shape at the rear of the sandal with their ends at the sandal toe.

Weft. Shredded whole yucca leaves.

Weave. Starting at the U-bend at the rear, we have a loose wickerweave with the warps usually spreading to make the tread wider at the toe. The broad ends of the weft leaves protrude on the under side to form a wearing pad.

Toe Loop. The toe loop is formed by shredding the opposite warps, giving them a turn on themselves, and completing the loop by tying the ends together with a square knot. This loop takes only a single toe, either the second or third.

Side Straps. One to 3 small bundles of shredded leaves are passed through the tread and between the 2 flat warps just behind the ball of the foot. These straps are crossed at the toe loop, and each set is tied to it with a square knot, as in Type 5, fish-tail scuffer toe sandal.

Size. The width at the toe varies from 2 1/2 to 4 inches, while the heel narrows to 1 1/4 and 1 1/2 inches; lengths, 5 1/2 to 7 inches; 1 child's sandal, 1 1/2 inches wide and 4 1/2 inches long. By noting the lengths of the broader sandals worn by adults, it can be seen that the longest, 7 inches, would be only three-quarters size and could have given no protection to the wearer's heel.

These sandals are usually an elongated ovoid form. In some cases the warps are more nearly parallel, giving the form of a flattened ellipse. The centered toe loop allows use on either foot.

Type 11, Two-warp Full-length Sandal (figs. 91, 92)

Quantity. Fourteen specimens suitable for measurements; 1 heel fragment.

Warp. One to 3 yucca leaves on either side, usually softened by twisting; the ends of the leaves are joined with a square knot at the heel; the upper ends are left free to form the toe loop; 1 specimen with 2 superimposed flat warp leaves, bent U-shape as in the Type 10 toe sandal.

Weft. Bundles of leaves softened by shredding; weft of 1 sandal a loosely twisted soft-fiber rope.

This sandal presents a loose over-and-under weave with the weft ends protruding on the under side as an additional pad.

Toe Loop. Opposite twisted warp strands are turned on themselves to compress the wefts, then passed over and through the instep loop, and the ends are tied on top in a square knot. The loop is very large, extending back over the instep, and will take the first and second, or even all 3 middle toes.

Heel Loop and Tie Strings. A single strand of loosely twisted fiber is passed through the sandal and around the warps on either side with a well-secured hitch to form the heel loop (hitch similar to that in Type 7). The ends of this strand become tie strings, and, after engaging the toe loop, are joined over the instep with a square knot.

Size. The widths are 2 1/2 to 4 inches; lengths, 5 to 9 inches. The majority are 3 to 4 inches wide by 7 to 9 inches long. Available specimens seem suitable only for women or children.

The edges are nearly parallel, with the heel and toe equally broad and rounded. The sandals may be worn on either foot.

Type 12, Five-warp Full-length Sandal (figs. 91, 92)

Quantity. One specimen.

Warp. Five single, narrow yucca leaves, large ends at the toe; each outside warp at the toe turned upon its neighbor and all warp ends interlocked; each warp at the heel is split, forming 10 elements, each element turned on the element to the right across the heel, and the operation again repeated back to the left; the heel of the specimen is badly worn, and the outer warp on either edge presumed to be secured by a single knot as illustrated.

Weft. Shredded yucca leaves.

Weave. Here we have a loose over-and-under weave, apparently starting at the toe, as indicated by the splitting of the warp elements to join them in finishing off the heel. The ends of the wefts protrude on the under side but do not form a very effective pad.

Toe Loop. A strand of shredded fiber is passed around 2 of the inner warps near the toe. The loop which is large and extends well up on the instep, will take more than 1 toe if desired. One section of the toe-loop cord is disengaged and hooked around the opposite loop strand to reduce the size of the opening for the toe.

Heel Loop and Tie Strings. Two strands of shredded fiber are tied together to make a long string, which is passed around the outside warps with a secure hitch on either side of the heel to form a heel loop. After the ends have been tied together with a single knot over the instep, they meet 1 end of a toe-loop strand in a clumsy knot to take up slack; the three are joined and then passed around the ankle loop and their ends tied to the opposite toe-loop strand with a square knot. The method of fastening to the foot seems to be about the same as in Type 11.

Size. The width at the toe is 4 1/2 inches; width at heel, 3 1/4 inches; length, 11 1/2 inches.

This sandal has a rather square toe and heel with a broadening at the toe. It may have been worn on either foot.

Type 13, Six-warp Full-length Shoe Sandal (figs. 91, 92)

Quantity. One specimen.

Warp. Six single yucca leaves; large ends of leaves at the toe; warp strands twice the length of the finished tread; warps are divided into pairs by tying ends together with a square knot at the heel.

Weft. Single, shredded yucca leaves.

Weave. Manipulation of the wefts starts at the heel in a moderately tight over-and-under weave. The ends of the wefts protrude on the under side, but are not left long enough to furnish much pro-

tection to the sole. When the desired length was reached, the wide ends of the warp leaves were shredded and turned back on the upper side toward the heel as part of the flap covering the toes and instep. However, before this was done 8 additional warps were inserted in the flap by looping an independent shredded leaf behind each inner warp. Another shredded leaf was then threaded through the bends in the warps and the ends of this strand added 2 more warps to the toe flap, making 16 in all. The elements of the flap are bound together by 4 transverse courses of twined fiber, the last twining holding down the free ends of the toe flap which have been turned and loosely knotted.

Toe Attachment. Along the sides of the sandal a twisted fiber cord is looped around the outer warps, forming 4 loops on either side, and passing across the flap near the toe.

Heel Loop and Tie Strings. On either side of the heel a strand is passed around the outer warp with a half hitch to form a heel loop. The ends of this strand are attached to the corners of the flap, pulling it back toward the ankle. Although not present on the specimen, it is probable that an additional lashing cord ran through the side loops, binding down the flap to cover the toes and instep. The sandal was stuffed with soft grass.

Size. Width, 4 1/2 inches; length, 11 inches.

Type 14, Full-length Soft Yucca-string Sandal (figs. 91, 92)

Quantity. Three complete, 6 fragments.

Warp. Two-ply, loosely twisted yucca-fiber cord; 1 complete and 4 fragmentary specimens with 4 warps, presumably the standard number; 1 complete with 2 warps, 1 with 3, 1 fragment with 6, and another with 10, all variations of this type; toe loop, heel loop, and tie strings the same in all.

In the standard sandal 4 warps are formed by looping 2 strands at the toe, the outer warps joined at the heel with a square knot, inner warps twisted together and wrapped around this knot. The warp bends at the toe are held in place by a whipping of untwisted fiber, which is continued on the outer warps 1 1/2 to 2 inches down each edge. A similarly thickened selvage is formed at the heel by additional turns of the last weft around the knot joining the outer warps and around the twisted ends of the inner warps which are wrapped around this knot. The matting down of the wefts by the wearer's heel makes clear the protective value of the heavy roll selvage, a characteristic of this sandal. The 2-warp specimen is built upon a single strand bent to U-shape, its ends tied with a square knot at the heel. That with 3 warps, by a single looped strand for the outer warps, the third tied to the center of the bend at the toe; at the heel the warps are split and joined to each other with square knots. The ends projecting from the square knot were divided and twisted into 2-ply strands, 6 in number. This cluster is held together by a half-hitch of one of the elements, and the whole bunch is bound down by the wefts along the selvage on one edge. In each of the sandal fragments having 6 to 10 warps the toe is missing, but since the 12-warp fragment has the same rolled heel as the standard 4-warp specimens, the warps at its toe and in those with 6 and 10 warps were presumably fastened together as in the 4-warp type.

Weft. Loosely twisted soft yucca fiber.

Weave. The weaving starts at the toe. The weft is continuous throughout the entire length. At each crossing additional twists of fiber, approximating in bulk those in the weft itself, are laid into the weft From the toe to the beginning of the heel, the ends of these added fibers protrude along the upper edge and conceal the selvage; around the heel their ends emerge on the under side as a pad for that part of the sole. These protruding ends of inlaid weft fibers are left long at the toe to form a bumper, but along the edges appear to have been trimmed to uniform brush-like length. The weft is well beaten down, making a more compact and flexible fabric than that of sandals woven with whole or partially shredded and twisted yucca leaves.

Toe Loop. A multiple-strand toe loop is formed by a small skein of 2-ply string, looped around the selvage on either side of the knot or wrapped attachment of the warps at the toe. There are examples with toe loops of 5, 8, 12, and 16 strands. The loop is large enough for the second and third toes.

Heel Loop and Tie Strings. The ends of 2 strands, 2-ply, are joined with a square knot. At this knot the cords are separated and pass around the toe loop. They are tightly twisted together for a distance of from 1 to 1 1/2 inches beyond the toe loop, where they fork over the instep, each one passing around the outer warp with a hitch at the side of the heel. One strand is then bent around

itself and the opposite instep cord, drawing the pair together in front of the ankle. This strand passes around the back of the ankle and is tied with a square knot to the opposite cord to complete the heel loop.

Size. The width of the frame at the toe is 3 inches; lengths, 8 1/4, 9, and 10 inches.

Apparently no intentional shaping for right or left; the centered toe loop permits use on either foot.

SUMMARY

Distribution. Because they differ so widely from the run of Southwestern sandals, and also because of the large number recovered, the Hueco Basket-maker scuffer toe sandal and its distribution must first be considered. The much rarer full-length sandals cannot, however, be disregarded, since some of them, like the toe sandal, are of the Basket-maker period. For this reason, 3 types of the full-length sandals are included in the discussion.

In all, 1016 whole and fragmentary toe sandals were recovered, 65 per cent of which were complete enough to be measured. Of these, 923 came from Ceremonial Cave in the Hueco Mountains, 46 from other near-by caves, 33 from Chavez Cave to the northwest on the Rio Grande, 3 from Buffalo Cave in extreme southwestern New Mexico, 2 from Doolittle Cave in the Mimbres Valley, and 9 from Steamboat Cave, the latter 2 sites in the Upper Gila area. In the collection of toe and full-length sandals from all areas, 14 types were recognized, of which half, with from 2 to 8 subtypes, were of the scuffer toe variety.

We wish to emphasize the uniformity of the toe sandals. We realize that some doubt may be felt as to the close relationship of broad-heel to the fish-tail examples, but we believe that the two are allied, and we hope to show that the variations are simply matters of technique. Attention will also be called to the relationship of toe sandals to certain full-length specimens with heel ties. The latter we consider to have developed from the toe sandal rather than to have been the result of influence from some other culture.

Among the many varieties of toe sandals, the three from Ceremonial Cave that belong to the 4-warp shredded-weft Type 1*c* (figs. 87, 88) are of particular interest. Like Type 4 sandals, they possess reversed-leaf side straps and in contour, with the warps drawn to cross at the end, they are true fish-tails. From the same site also came 2 specimens of whole-leaf 3-warp sandals. One is the rear end and the other a small complete example 2 1/2 inches wide and 3 1/2 inches long, a duplicate of the Type 1*a* sandal. These 3-warp specimens and the Type 1*c* 4-warp sandals definitely link the broad-heel Types 1*a* and 1*b* with the 2-warp fish-tail group. Whether or not the 4-warp sandal was a later improvement can only be surmised, but, of greater importance, it is evident that there is a relationship between the 2 forms. Another example of kinship among these sandals (mentioned on p. 87 in describing the combination Type 3+5*a* specimen shown in figures 89 and 90) is the use of a Type 3 toe loop on a Type 5*a* body.

The inception of the full-length sandal with ankle fastenings is shown in a Type 3 and a Type 5*c* infant's sandal from Ceremonial Cave, and is more strongly brought out in the above-mentioned Type 3+5*a* sandal from Cave 4 (Buffalo Cave) in extreme southwestern New Mexico. Although these are both radical departures from the regulation toe sandal, they indicate that the more efficient sandals with heel loop and instep ties evolved from fish-tail sandals; and it will be shown that these accessories were later embodied in the full-length Types 7 and 8 sandals, found in Ceremonial Cave. There is also a similarity in the manipulation of heel and instep ties in the 3+5*a* fish-tail example and in Type 14 early(?) Pueblo soft-cord sandals (figs. 91, 92) found in the Upper Gila.

A single twilled toe sandal (Type 6, figs. 89, 90), from Buffalo Cave, differs from the general run of Hueco toe sandals. Most of the artifacts from this cave such as a fragment of a bow, a reed arrow, and a few sherds of plain brown pottery are of Pueblo origin, yet the presence of Types 3*d* and 3+5*a* toe sandals in the same place indicates previous visits by the Hueco Basket-makers. The plaited weave of the specimen in question might seem to connect it with the full-length plaited Pueblo sandals of the Upper Gila; we believe, however, that it really belongs in the southern Hueco category. Nevertheless, its exact status cannot be determined until more material is available.

The importance of the Type 10 toe sandal, which did not appear in the Hueco area, must now be mentioned. Even though the warps in this type are not separate leaves on either side, as in the Hueco toe sandal, but are single leaves bent into

Type	1a	1b	1c	2	3	4a	4b	5a	5b	5c	5d	5e	5f	Comb. 3+5a	6	7	8	9a	9b	10	11	12	13	14
HUECO AREA																								
Ceremonial Cave	112	19	1	24	234	14	26	26	11	29	46	68	4			8	4							
Picture Cave	2	1		1	1	1	3																	
Cave 1		1							1				1											
Cave 2	3				1			6																
Cave 5					1		2																	
Cave 6						4	10	1																
Cave 7							3																	
Cave 9								3											5					
Chavez Cave	8			1	3	4	1	5	4	1	6													
Cave 4 (Buffalo Cave)					1									1	1									
Cave 6 (Pinnacle Cave)						1																		
UPPER GILA AREA																								
Doolittle Cave	1							1										14	25					
Steamboat Cave																				9	9			
Site 3, Mogollon-Sapillo																					2			
Water Canyon Cave																					1			
Cave 1, Middle Fork																					1			
Cave 2, Middle Fork																								1
Cave 2, West Fork																								5
Kelly Cave																		6			2	1	1	
Cave 1, Goat Basin																		1						3
Cave 5, Sipe Canyon																		3	6					
Mule Creek Cave																		7	5		1			

TABLE 1. Source, quantity, and type of sandals found at sites in the Hueco and Upper Gila areas. Sandals of the following types: Type 1*a*, four-warp scuffer toe; Type 1*b*, four-warp half-sole scuffer toe; Type 1*c*, four-warp short scuffer toe; Type 2, two-warp scuffer toe; Type 3, two-warp scuffer toe; Type 4*a*, two-warp fish-tail scuffer toe; Type 4*b*, two-warp fish-tail toe sandal; Type 5, two-warp fish-tail scuffer toe; Type 5*a* (p. 87); Type 5*b* (p. 87); Type 5*c* (p. 87); Type 5*d*, (p. 87); Type 5*e* (p. 87); Type 5*f* (p. 87); combination Type 3+5*a*, full-length two-warp sandal with heel loop and tie strings; Type 6, twilled scuffer toe; Type 7, two-warp full-length; Type 8, two-warp full-length; Type 9*a*, full-length turned-heel; Type 9*b* (p. 89); Type 10, two-warp scuffer toe; Type 11, two-warp full-length; Type 12, five-warp full-length; Type 13, six-warp full-length shoe sandal; Type 14, full-length soft yucca-string.

a U-shape, the fact that Type 10 has no heel or instep attachments, and that its side straps are so far forward as to make it a scuffer, render it, to our minds, a close relative of the Hueco Basket-maker sandal. Further evidence to this effect is that 2 Type 10 specimens were found in one of a series of cists in Steamboat Cave, underlying fill containing fragments of coiled-netted weave on warp foundation cloth, pieces of darts, dart foreshafts, and other Basket-maker objects. As all Type 10 specimens came from Steamboat Cave in the Upper Gila country, they indicate a wide distribution of the general Hueco category that serves to enhance the possibility of contacts between southern and northern Basket-makers.

That the practice of bending a single leaf to make a 2-warp foundation was widespread is shown by a sandal found by Coffin in Bee Cave Canyon in Brewster County, Texas.[3] It is much like the Type 10 examples from the Upper Gila. Its occurrence in the Big Bend country, so far south in Texas, with no representative of the type in the Huecos, is at present unexplainable; but a connection with the Huecos is demonstrated by Coffin's finds in the Bee Cave Canyon shelter of a full-length Type 8 and a Type 4*b* toe sandal (fig. 11, *a*, *b*, p. 49, same report), numbers of which came from Ceremonial Cave in the Huecos.

In discussing the postulated development from full-length to toe sandals (seen in the Type 3+5*a* specimen), reference was made to the 2-warp, full-length Type 7 and 8 sandals from Ceremonial Cave (see above). Although there were so very few (8 of Type 7 and 4 of Type 8) in comparison to the great number of other sandals found there, they are nevertheless of considerable significance, due to their relation to the distinctive fish-tail and

[3] Coffin, 1932, fig. 10, *a*, p. 48.

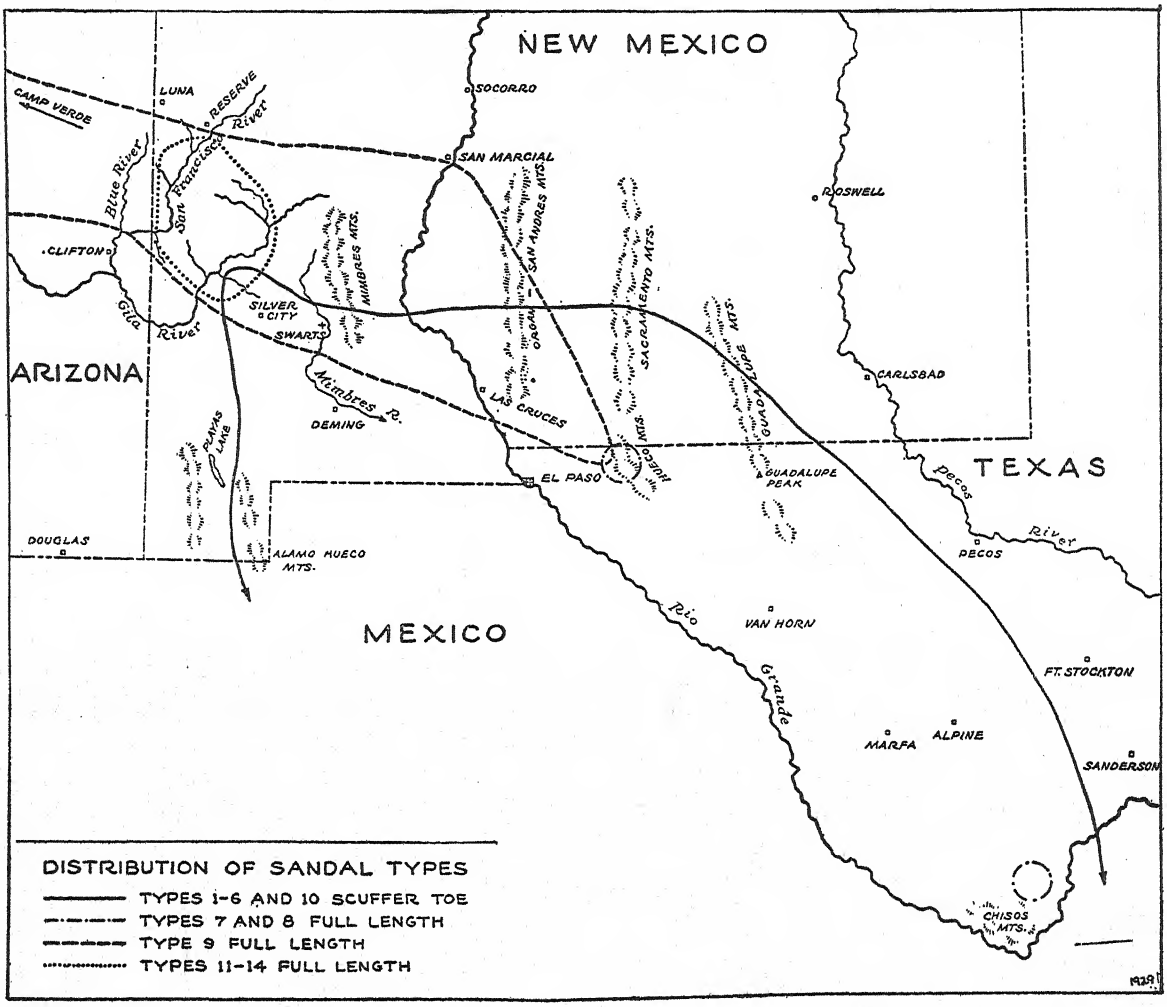


FIG. 32. Distribution of sandal types (1929).

other forms of toe sandals from the Huecos and from the region to the southeast. The family resemblance is strong in Type 7, in which the fish-tail effect is prominent and Hueco traits can also be seen in the rough Type 8 sandal. A specimen of Type 8 and a fish-tail sandal have just been mentioned as found together by Coffin in the Big Bend.

From the foregoing we conclude that Types 7 and 8 full-length sandals are part of the Hueco Basket-maker toe-sandal complex, even though they have to date appeared at but 1 site in the Huecos and 1 in the Big Bend.

The distribution of sandal complexes is plotted on figure 32, where that of toe sandals is shown to center in the Huecos. To the southeast, Coffin's discoveries extend the area of distribution down the Rio Grande into the Big Bend country; and along the west side of the Pecos the toe sandal continued to make its appearance—at Guadalupe Peak; at the southern end of the Guadalupe Mountains in Culberson County, Texas, where Howard found a Type 4*b* sandal;[4] on the eastern slopes of the Guadalupe Mountains, 40 to 50 miles west of Carlsbad, New Mexico, in Anderson Canyon and in Three Forks Canyon, where Howard also collected scuffer toe sandals. Those from Anderson Canyon Cave were of Type 1*b*,[5] Type 2,[6] and Type 4*b*.[7] In the same district,

[4] Howard, 1930, pl. XXIX, 1.
[5] Howard, 1930, pl. XXXIV, 1 and 2.
[6] Howard, 1930, pl. XXXIV, 3.
[7] Howard, 1930, pl. XXXV, 1 and 2.

Howard also found a Type 4*b* sandal in Burnet Cave which is situated in Three Forks Canyon.[8]

By the courtesy of Mr. H. H. F. Jayne and Dr. J. A. Mason of the Museum of the University of Pennsylvania, we were able to examine the sandals gathered by Dr. Howard. Among these, not illustrated in his reports, was a Type 1 and a Type 4*a* sandal from Anderson Canyon Cave, a Type 4*b* from Rustler Hill Cave, a Type 1 from Roberts Canyon, a Type 4*b* from Shattuck Cave, and a Type 1 from Dark Canyon. The above last 4 sites are also on the east slopes of the Guadalupe Mountains.

Farther west in Chavez Cave on the Rio Grande, near Las Cruces, N. M., were found Types 1, 3, 4, and 5 (with subtypes) of the fish-tail toe sandal. To the northwest Doolittle Cave in the Mimbres Valley yielded fragments of Types 1 and 5; and considerably farther north in the Upper Gila, Type 10 toe sandals came from Steamboat Cave. South of that point, the next contact made with the toe sandal was in Cave 4 (Buffalo Cave), close to the international boundary in southwestern New Mexico, where Types 3*d* and 3+5*a* were found. As no investigation was done below the border, we have no data on sandal types from the area south of western New Mexico or west of the Rio Grande in Chihuahua. The same would be true of Coahiula, south of the Big Bend, were it not for the finds by Professor Edward Palmer in 1880 of specimens in burial caves 200 to 300 miles south of the Rio Grande. Among these are sandals from Acateta Burial Cave, southeastern Coahuila, now in the Peabody Museum. Although they are all full-length with heel and ankle attachments, several are woven over 2 wide leaf warps and have a decided fish-tail (fig. 93, *a*). That some of the coarsely woven Coahuila sandals with reinforcing longitudinal strands made their way across the river into the Big Bend is shown by the fact that Coffin found them in Bee Cave Canyon,[9] as did Pearce and Jackson[10] and Martin[11] farther north and east at the mouth of the Pecos. These specimens, although not having the decided fish-tail of those just mentioned, are similar to other full-length sandals obtained by Professor Palmer in the Coahuila burial caves.

Their resemblance to the distinctive Hueco fish-tail toe sandal, one of which was found at Bee Cave by Coffin, and a similarity of other artifacts from Hueco, Coahuila, and Big Bend areas, shows an overlapping that seems to indicate contemporaneousness of the cultures found in them.

The occurrence of Type 10 toe sandals in Steamboat Cave in the Upper Gila area and in the Big Bend of Texas suggests a cultural relationship between peoples at the 2 extremes of the region.

In the few full-length Hueco sandals there are similarities to the northern sandals in handling the heel loop and tie strings. These might be considered fortuitous were it not for the fact that the Type 10 scuffer toe sandal from Steamboat Cave indicates the presence of a Hueco trait in the Upper Gila country, where other Basketmaker artifacts have also been found.

The full-length sandals of Types 7, 8, and 3+5*a* (a variant of the fish-tail sandal) seem allied to the toe sandal and are confined, as far as we know, to the central and southern Hueco area. Some Type 9 sandals were discovered in the Hueco Mountains at Cave 9, but a greater number were found in the Upper Gila, where Types 11, 12, 13, and 14 also made their appearance.[12] Some of these forms extend well into Arizona and east as far as the Rio Grande in New Mexico. The northern and western distribution of our types of full-length sandals have not as yet been ascertained. In our collection there are 97 whole and fragmentary specimens, 28 of them being Type 9*a*, 44 Type 9*b*, 14 Type 11, 1 Type 12, 1 Type 13, and 9 Type 14.

Type 9 sandals, plaited rather than cross-woven and with characteristic turned heel, are first discussed because of the fact they were found in greater number and over a wider area than other full-length sandals. As the map (fig. 32) shows, they come from Cave 9 in the Hueco Mountains; at Doolittle Cave in the Mimbres; and to the northeast, over 100 miles beyond the Mimbres, at 4 sites (Cave 1, Goat Basin; Cave 5, Sipe Canyon; Mule Creek Cave; and Kelly Cave) in the San Francisco country and part of the

[8] Howard, 1930, pl. XXXV, 3.

[9] Coffin, 1932, fig. 5, *c* and fig. 6, *a–c*.

[10] Pearce and Jackson, 1933, pls. XIX and XXI.

[11] Martin, 1933b, pls. XVI, XVII, and XVIII.

[12] In addition to our sandals from Kelly Cave, Upper Gila area, R. C. Eisele collected from the same site 15 of Type 9 (*a* and *b*), 4 of Type 11, and 6 of Type 14. With these were 5 heavy, coarse, 4-warp soft sandals with round edges. Attachment to the foot in the latter specimens is the same as in our Type 11, and they seem to be a better made sandal of that class, having 4 warps instead of 2.

Upper Gila drainage in western New Mexico. Hough also illustrates a Type 9 sandal from Tularosa Cave in the San Francisco district,[13] and Haury finds that Type 9 sandals, both *a* and *b*, predominate at the Canyon Creek Ruin (C: 2: 8) in eastern Arizona, about 115 miles west of the Tularosa Valley.[14] Evidence of farther extension in a northwesterly direction is seen in the turned-heel plaited Type 9*a* sandals found by Morris in the ancient salt mine at Camp Verde, 35 miles east of Prescott, Arizona.[15] This is the westernmost known occurrence. The northernmost in New Mexico is in the neighborhood of San Marcial, on the Rio Grande, where M. R. Harrington named a site "Sandal Cave" because of finding quantities of sandals (our Type 9*b*) at that place.[16]

Cultural Affinities. Turning from distribution to the problem of cultural affinities, there is little doubt that the Type 9 sandal was a Pueblo, rather than a Basket-maker product. Out of 72 sandals of this type collected by us, thirty-nine came from Doolittle Cave which, although it yielded some evidence of earlier Basket-maker occupancy, was predominantly a Mimbres shrine. And since nothing but Classic Mimbres pottery was found there, we feel safe in assigning Doolittle Cave to Pueblo III.[17] At Cave 9 in the Hueco Mountains (p. 40), El Paso Polychrome sherds were found, suggesting that this form of sandal continued to be used well toward the end of Pueblo III.[18] In the Upper Gila country at Kelly Cave and Cave 5, Sipe Canyon, on the San Francisco, Type 9 sandals occurred in association with such Pueblo materials as reed arrows, cotton cloth stub pahos, Mimbres Bold-face sherds, and Tularosa sherds. The Mimbres sherds are early and middle Pueblo III, and the Tularosa sherds late Pueblo III and possibly early Pueblo IV. On the basis of tree-ring dates, Haury found that the Canyon Creek Ruin, from which numbers of these sandals came, was occupied until shortly after 1348,[19] i.e., to about the beginning of Pueblo IV. At 2 other sites in this country, Mule Creek Cave and Cave 1, Goat Basin Canyon, where Type 9 sandals were found, there were, indeed, signs of Basket-maker occupancy, but the bulk of the material was predominantly Pueblo III. Hough encountered a like condition at Tularosa Cave, farther up the San Francisco, where there was a mixture of Basket-maker and Pueblo artifacts; among the latter were corrugated and plain pottery fragments. In describing an 8-element twilled-woven turned-heel sandal analogous to our Type 9*a*, Hough says: "This style of sandal was most numerous in the cave debris."[20]

We now consider the full-length cross-woven sandals of Type 11 (p. 90, figs. 91, 92). Nine of these came from Steamboat Cave on the southern side of the Upper Gila area; one from Site 3, Mogollon-Sapillo Creek section of the Gila; one from Cave 1, Middle Fork of the Gila; 2 from Kelly Cave, south of Reserve, New Mexico, on the San Francisco; and one from Mule Creek Cave on the San Francisco near the New Mexico-Arizona line. The area enclosed by tracing through these points (fig. 32) is not extensive, but further exploration may well enlarge it. At Steamboat Cave both Basket-maker and Pueblo artifacts were found, and the same was true at Cave 1, Middle Fork of the Gila, and at Kelly Cave on the San Francisco. Site 3 on the Mogollon-Sapillo Creek section of the Gila River, and Mule Creek Cave on the San Francisco yielded nothing but Pueblo specimens. The latter, as has been previously stated (p. 30), was a shrine utilized throughout several periods in the Pueblo cycle.

In general appearance Type 11 sandals suggest a Pueblo product, which might be expected of specimens from caves producing Upper Gila, Tularosa, and Classic and Bold-face Mimbres sherds as well as other middle and late Pueblo III objects. There are, however, indications that they were manufactured at an even earlier date. The first is a Type 11 specimen from Steamboat Cave that resembles Type 10 toe sandals found there, which in turn seem to have some connection with the Hueco Basket-maker toe sandals farther south. The resemblance, as brought out in the description of this aberrant Type 11 example (p. 90) lies in use of 2 superimposed warp leaves, bent into a U-shape instead of shredded or twisted leaves knotted at the heel. To be sure, this is slight evidence on which to connect standard Type 11 with early toe sandals, but when it is recalled that a Type 11 sandal came from a cist in Mule Creek Cave, it at least points to a pos-

[13] Hough, 1914, fig. 172, p. 83.
[14] Haury, 1934, p. 64; plate XLI.
[15] Morris, 1928, fig. 3, p. 84.
[16] Harrington, 1928a, pp. 5–10.
[17] Cosgrove, 1932, p. 112.
[18] Cosgrove, 1932, pp. 110–11.
[19] Haury, 1934, fig. 5; p. 152.
[20] Hough, 1914, p. 84.

sibility of a Pueblo I or II origin, for in that cist there were also a rush mat, part of a fur-cloth blanket, and 2 leaf containers (fig. 102, *a*, *d*), very similar to the "Yucca-top Baskets" identified by Guernsey as Basket-maker II and III.[21]

The Type 12 sandal from Kelly Cave on the San Francisco, where Basket-maker and late Pueblo III articles were found, is still another form of Upper Gila footgear (p. 90). Its status is as yet undertermined, although it may belong to the multiple-string warp category of Type 14 sandals. Since we have but 1 specimen, as was the case with the Type 6 plaited toe sandal, we have hesitated to give it type status, but its 5-warp foundation and carefully finished heel in an otherwise coarse sandal may indicate that it is not merely an aberrant. If not, its distinctive characteristics will serve to render easily recognizable other examples which may come to light in future excavations.

There is one more odd specimen in the collection. This is the shoe sandal from Kelly Cave (figs. 91, 92, Type 13; p. 90). In this case we feel justified in considering it a type (our Type 13), despite the fact that we have only 1 specimen, for Hough found shoe sandals in Tularosa Cave in the same area farther north on the San Francisco which differ from ours only in that their toe-flap cross wefts are more closely woven.[22] As Hough remarks, they are a specialized product, more comfortable and warmer than the ordinary sandal. Sandals without the toe flap but having grass padding and side loops for lacing are not confined to this area. Peabody Museum possesses examples from northern Arizona which are considered to belong to the first 3 Pueblo periods.

Of Type 14 soft yucca-string sandals, there are 3 complete specimens and 6 fragments (figs. 91, 92; p. 91) from Cave 2, Middle Fork of the Gila; Cave 2, West Fork of the Gila; Cave 1, Goat Basin Canyon; and Kelly Cave (Eisele collection) on the San Francisco. Apart from a small section south of the Gila, they are now known to occur in about the same area as the Type 11 sandal (fig. 32). That they may have had a wider distribution is shown by Hough, who illustrates a sandal from Tularosa Cave, 50 miles to the north, which, except for having no brush above the selvage, appears to be identical to ours of Type 14.[23]

Type 14 sandals resemble those of Pueblo I sandals, even though they do not have as large tightly twisted cord warps and wefts, and the toe does not always tend to be pointed or the heel squared as in some of the Pueblo I examples found by Guernsey in northeastern Arizona.[24] The ties of the latter, however, are different.[25] Possibly indicative of the persistence of a Basket-maker weaving trick are 2 loosely twisted yucca-fiber-cord sandals found by Kidder and Guernsey in Basket-maker II sites in the Marsh Pass region, which, like our Puebloan Type 14, have the trimmed ends of inlaid wefts emerging on the upper side of the tread, thus concealing the selvage (fig. 93, *b*). In outline as well some northern Arizona Pueblo I yucca-cord sandals are much like Type 14.

Conclusions. In spite of the always unsatisfactory stratigraphic conditions encountered in caves, we believe that the foregoing detailed analyses and comparison of weaves, together with certain bits of definite archaeological evidence—such, for instance, as the finding of a fish-tail sandal in a Hueco Basket-maker grave—have resulted in reasonably safe assignment of most sandal types to one or the other of the 2 main cultural horizons—Basket-maker and Pueblo—so far recognizable in the region. We believe that resemblances in weaves, and in some cases actual cross-finds of practically identical specimens, have served to tie the Hueco and Upper Gila areas together on both horizons and the Huecos to the Big Bend of Texas on the earlier. We further believe that, in sandal-weaving, certain Basket-maker tricks and techniques were carried on through early into classic Pueblo times. And in this connection there should not be overlooked the persistence from the one period into the other of the apparent custom of leaving worn-out footgear as cult offerings in shrines, practised by the Basket-makers at Ceremonial Cave in the Hueco Mountains and by Pueblo at Doolittle Cave in the Upper Gila area. Finally, the finding by Alexander and Reiter at Jemez Springs in central New Mexico of toe sandals, some duplicating and others closely similar to our Type 3,[26] serves partly to bridge the great territorial gap

[21] Guernsey, 1931, pl. 11, *a–d*.
[22] Hough, 1914, fig. 176, p. 85, and fig. 177, p. 86.
[23] Hough, 1914, fig. 174, p. 84.
[24] Guernsey, 1931, pl. 57, *a*, *c*, and *d*.
[25] Guernsey, 1931, fig. 24, p. 67.
[26] Alexander and Reiter, 1935, pl. XX, *g*.

between the Basket-maker region of southwestern New Mexico and that of the San Juan Basket-makers of northeastern Arizona. As yet unexplained, however, is the apparent entire absence in the south of the beautiful "cloth" sandals, produced in the north by both Basket-makers and Pueblo. Still another hint of continuity, in this case both spatial and chronological, is furnished by likenesses between our Type 14 sandal, thought to be early Pueblo, and Guernsey's coarse San Juan Basket-maker specimens (fig. 93, *c*). The similarity is in the common presence of a protective upper fringe concealing the outer warps (see above). How significant this minor detail may be is of course uncertain, but it emphasizes the importance of close scrutiny of weaves and, in publications, the need of full description and clear illustration. It is also most desirable that more material should be gathered from other parts of the Southwest.

BASKETRY AND MATTING

COILED BASKETRY

One-rod Foundation, Coarse-weave Yucca Sewing Element (figs. 33, *h, i;* 94, *a*)

Source and Quantity. Hueco area—Ceremonial Cave; Chavez Cave; Cave 3, Deer Creek—4 specimens.

Materials. Rods, unpeeled twigs; sewing element, strips of heavy *Yucca macrocarpa* leaves.

Weave. Interlocked stitches: 5 stitches, 4 rods to the inch; sewing element 1/8 to 3/16 of an inch wide; from 50 to 100 per cent of the stitches intentionally split on both sides; 1 specimen with no split stitches on inner surface, but with all stitches split on outer surface. In some cases the sewing element does not encircle the rod below but passes through the rod, splitting it into halves (fig. 33, *i*) or even smaller sections. This produces a tighter weave. The coarse furcate sewing elements produce a rough surface with rods more or less exposed.

Shape and Size. Fragments indicate medium to large shallow baskets.

Decoration. There is no decoration.

Most of the stitches are charred and destroyed on the inner surface, supposedly because nuts or corn have been parched in the baskets with live coals.

One-rod Foundation, Fine-weave Wood-splint Sewing Element (figs. 33, *h;* 94, *b*)

Source and Quantity. Hueco area—Ceremonial Cave, 1 specimen.

Materials. Rods, unpeeled twigs; sewing element, flexible wood-splint.

Weave. Interlocked stitches encircling rod below; 7 stitches, 5 rods to the inch; sewing element 1/16 to 1/8 of an inch wide.

This narrow sewing element is not split on the outer surface. The weave on this surface has the appearance of bars at right angles to the rods. Seventy per cent of the sewing elements are split on the inner surface. The weave is tight and the rods not exposed as in one-rod coarse-weave basketry.

Shape and Size. It is difficult to determine from fragments, but from the fact that the unsplit stitches are on the outer or convex working face and that the opposite side is coated with pitch, it seems that they may be parts of a water jug.

Decoration. There is no decoration.

One-rod Foundation, Wood-splint Sewing Element Sifter Basket (figs. 33, *d;* 97, *a*)

Source and Quantity. Upper Gila area—Water Canyon Cave, base of a single basket.

Materials. Rods, unpeeled twig; sewing element, flexible wood splints.

Weave. Multiple stitch-and-wrap, interlocked; 10 stitches, 4 coils to the inch; sewing element 1/16 to 1/8 of an inch wide.

The rod is wrapped several times with the sewing element, and at irregular intervals 2 or 3 stitches pass completely around the rod below.

Shape and Size. The shape and size cannot be determined.

Decoration. All splints are light red, but this seems to be the natural color of the wood.

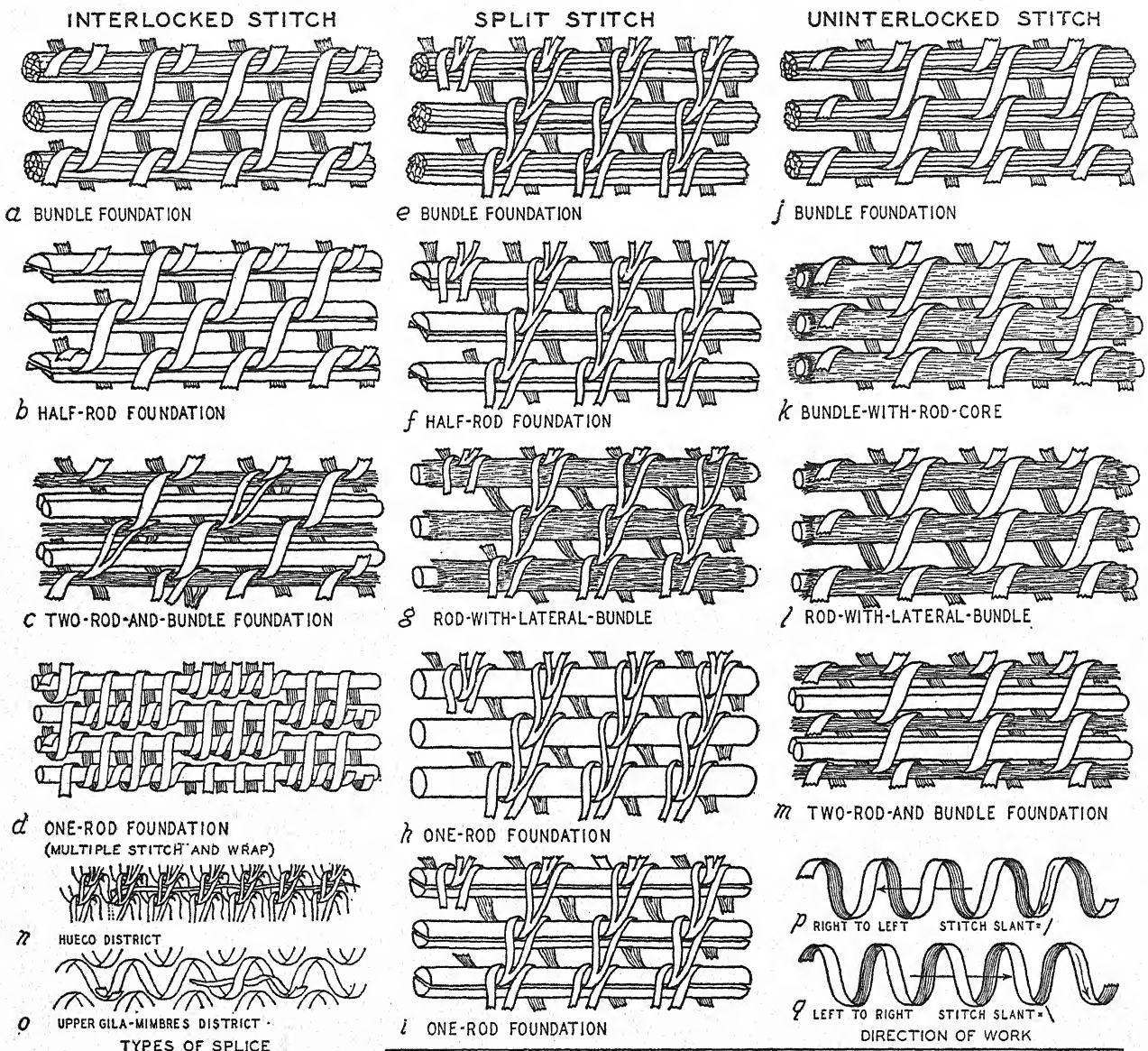
The stitch may be called either Hough's "lazy stitch,"[1] or Mason's "interrupted coiled work."[2] Weltfish describes the sifter baskets of this type mentioned by Hough as having a grass-bundle instead of a rod-and-bundle foundation as shown by Hough; and states that the 12 baskets found by him range from 2 to 5 1/4 inches in diameter.[3] Emil W. Haury tells us that he and E. J. Hands found an 8-inch sifter basket with weave similar to ours in a Basket-maker child burial in a cave between the Lukachukai and the Carrizo Mountains in northeastern Arizona. The weave is two-rod-and-bundle triangular foundation, and the splints binding the fabric together pass through the bundle below instead of encircling the entire foundation. A decorative effect is procured by the binding stitches radiating in straight lines from the center.

In the Peabody Museum is a small basket 5 1/4 inches in diameter, 3 1/2 inches deep, and in form

[1] Hough, 1914, p. 124 and fig. 317.

[2] Mason, 1904, p. 480, fig. 173, pp. 28–30.

[3] Weltfish, 1932, pp. 28–30.



FREQUENCY AND DISTRIBUTION OF BASKET TECHNIQUES

	UPPER GILA AND MIMBRES				HUECO			
	WOOD SPLINT	YUCCA SPLINT	STITCH SLANT/	STITCH SLANT\	WOOD SPLINT	YUCCA SPLINT	STITCH SLANT/	STITCH SLANT\
a						17	16	1
b						24	23	1
c						3	3	
d	1		1					
e						8	6	2
f						5	4	1
g						10	10	
h					1	3	4	
i						1	1	
j						7	4	3
k	1			1	2	1	3	
l						4	4	
m	16	1	17		4	19	22	1

FIG. 33. Basket-wall techniques from the Upper Gila and Hueco areas. (See p. 101, for legend.)

much like the large cone-shaped storage baskets. It has the one-rod foundation bound with narrow, flexible splints and is pitch-coated inside on the bottom. Slightly below the rim is a 2-inch zone or band woven in the open "lazy stitch." Its form is entirely different from the open sifter baskets, but it would serve the same purpose. The specimen came from Johnson, Kane County, Utah, and was collected by Dr. E. Palmer in 1877.

The measurements given by Weltfish and Haury furnish some idea of the dimensions of this type of basket. Their descriptions and our specimen from the Upper Gila show that a one-rod, a grass-bundle, or a two-rod-and-bundle triangular foundation were used in "lazy stitch" sifter baskets.

Rod-with-lateral-bundle Foundation, Sotol Sewing Element (figs. 33, *g*, *l*; 94, *d*, *e*)

Source and Quantity. Hueco area—Chavez Cave; Ceremonial Cave; Cave 2—14 specimens.

Materials. Rods, unpeeled twigs; bundle, shredded yucca leaves or grass; sewing element, strips of sotol (*Dasylirion Wheeleri*) leaves.

Weave. Five to 8 stitches, 3 to 5 coils to the inch; sewing elements average 1/8 of an inch wide. In 4 specimens the stitches are uninterlocked (fig. 33, *l*). In the other 10 all stitches, even the unsplit ones, are interlocked (*g*). From 10 to 75 per cent of the stitches are split by the sewing element on the inner surface; 15 to 60 per cent on the outside. The bundle is laid on the convex side and the rod beside it on the concave surface or inside of the basket. The size of the bundle is double that of the rod. A small amount of the bundle is drawn around on the top and bottom of the rod, allowing the sewing elements which surround the foundation to pass through the part of the bundle on the course below. The weave is firm with stitches not entirely concealing the rod and bundle. In starting baskets the rod was usually bent into a spiral, but in 1 instance it was bent into an ellipse..

Shape and Size. Most fragments are parts of large, shallow baskets with flat bottoms; two with pointed bases may be parts of water jars.

Decoration. There is no decoration.

Several pieces of shallow baskets are charred on their inner surface from having had grain parched in them.

Bundle-with-rod-core Foundation, Wood-splint Sewing Element (figs. 33, *k*; 96, *b*; 97, *b*)

Source and Quantity. Upper Gila area—Steamboat Cave, 1 base fragment. Hueco area—Cave 1, complete basket; Ceremonial Cave, 1 fragment.

Materials. Rods, unpeeled twigs; bundle, shredded yucca leaves; sewing element, flexible wood splints.

Weave. Uninterlocked stitches encircle the foundation unit and catch the top of the one below; 6 to 8 stitches, 5 coils to the inch; sewing element 1/16 to 1/8 of an inch wide. The surfaces show very few split stitches, though more on the convex side than the concave, all accidental. The weave is firm, with stitches not entirely concealing the foundation.

Shape and Size. The complete basket has flaring sides and a flat base. Its depth is 6 inches; base, 7 inches in diameter; diameter at rim, 11 1/2 inches. One fragment, 3 inches in diameter, shows a pointed base.

Decoration. There is no decoration.

FIG. 33. Basket-wall techniques from the Upper Gila and Hueco areas. *a*, bundle foundation, interlocked stitch; *b*, half-rod foundation, interlocked stitch; *c*, two-rod-and-bundle foundation, showing both interlocked and split stitches; *d*, one-rod foundation, multiple stitch-and-wrap, interlocked, in blocks of three; *e*, bundle foundation, stitch split on work surface; *f*, half-rod foundation, stitch split on work surface; *g*, rod-with-lateral-bundle foundation, stitch split on work surface; *h*, one-rod foundation, stitch split on work surface (stitch encircles rod); *i*, one-rod foundation, stitch split on work surface (stitch pierces rod); *j*, bundle foundation, uninterlocked stitch; *k*, bundle-with-rod-core foundation, uninterlocked stitch; *l*, rod-with-lateral-bundle foundation, uninterlocked stitch; *m*, two-rod-and-bundle foundation, uninterlocked stitch; *a'–m'*, cross sections of coils taken from techniques *a–m*. Grass-bundle foundation shown in white outline; fiber bundle, stippled; rods and half rods, black. *n*, *o*, types of splice (coils with foundation removed; *n*, the standard type of splice in the Hueco basketry collection. The end of the new splint is carried as an element of the foundation for a distance of 2 to 3 inches and is then freed from the coil and used as a sewing splint. *o*, the standard type of splice of the Upper Gila-Mimbres collection and of the San Juan Basket-makers. The end of the new splint is a visisble stub on the work surface. The end of the used-up splint is a stub concealed or partly visible on the reverse surface. Sometimes the terminal end is a segment of splint 1 to 2 inches long turned and folded into the coil. *p*, *q*, direction of work (coils shown with foundation removed). *p*, splint coiled from right to left. The standard method of the San Juan Basket-maker, central Pueblo, Upper Gila, and Mimbres peoples. Used also by the Hueco Cave Dwellers in most cases. The stitch slant here is /.

The texture of both faces of the complete basket shows good workmanship in avoidance of splitting the stitches. The present bottom is a replacement of the original, constructed in the reverse direction, that is, from periphery to center. Thus the stitches pierce the under instead of the over edge of the next outward coil. Foundation of the secondary bottom is rod-with-lateral-bundle; the splint, yucca. Even the patch became worn in service and was mended with coarse stitches of *Yucca macrocarpa* leaves. At one time the exterior may have been coated with pitch as there are touches of this material still adhering to it. The inside is coated with dried mush. This basket was inverted over the head of the adult Hueco Basket-maker buried in Cave 1 in the Hueco Mountains.

Bundle-with-rod-core Foundation, Yucca Sewing Element (fig. 33, *k*)

Source and Quantity. Hueco area—Ceremonial Cave, 1 specimen.

Materials. Rods, unpeeled twigs; bundle, shredded yucca leaves; sewing element, yucca.

Weave. Identical with preceding except for the use of the yucca sewing element.

Two-rod-and-bundle Triangular Foundation, Sotol Sewing Element (figs. 33, *c, m;* 94, *f;* 96, *a*)

Source and Quantity. Upper Gila area—Mule Creek Cave, 1 specimen. Hueco area—Chavez Cave; Ceremonial Cave; Cave 1, 1 complete basket; Cave 7, 22 fragmentary specimens.

Materials. Rods, unpeeled twigs; bundle, shredded yucca leaves or grass; sewing element, strips of sotol (*Dasylirion Wheeleri*) leaves.

Weave. Stitches pass around bundle and rods and through the bundle below; 5 to 9 stitches, 3 to 5 coils to the inch; sewing element 1/8 to 3/16 of an inch wide. In 20 specimens the stitches are uninterlocked (fig. 33, *m*); in 1 they are interlocked; in 2, consistently split. For convenience, the last 2 manipulations are shown combined in *c*. Considerable accidental splitting occurs, more on the outer than on the inner surface, in the uninterlocked specimens. The weave is firm; the rods and bundles are not completely concealed by the sewing elements.

Shape and Sizes. Most fragments are of large shallow baskets, while 2 pointed bases appear to be bottoms of water jars. The small complete basket with flat bottom and flaring sides is 3 inches deep and 7 1/2 inches in diameter at the rim.

Decoration. There is no decoration.

Some pieces of large tray baskets are charred on the inner surfaces from having had grain parched in them. Fragments of a large basket show that it has been repaired by extra rods attached to the rim with wide-spaced groupings of flexible wood splints (fig. 103, *f*).

The worn bottom of the complete basket (fig. 96, *a*) has been renewed with coiling of yucca strips bound with coarse stitches of stripped *Yucca macrocarpa* leaves, sewed from the outside to the center. The inside is coated with dried mush. This basket was found inverted over the lap of the adult Hueco Basket-maker skeleton in Cave 1, Hueco Mountains.

Two-rod-and-bundle Triangular Foundation, Wood-splint Sewing Element (figs. 33, *m;* 95, *b, g*)

Source and Quantity. Hueco area—Chavez Cave; Ceremonial Cave; Cave 7—4 specimens.

Materials. Rods, unpeeled twigs; bundle, shredded yucca; sewing element, flexible wood splints.

Weave. Uninterlocked stitches around the bundle and rods and through the bundle below. In the fragment from Chavez Cave (fig. 95, *b*), there are 7 to 8 stitches and 5 coils to the inch; no intentionally furcated stitches. The weave is firm and the rods and bundles are not completely concealed by the sewing element.

In the fragment from Ceremonial Cave (fig. 95, *g*) there are 19 stitches and 7 coils to the inch. The elements are narrow and are not split in sewing. The fine weave of this specimen makes it foreign to the Hueco basketry and shows that it is no doubt of Pueblo origin.

Shape and Size. The fragment from Ceremonial Cave is too small for shape or measurements to be determined. The one from Chavez Cave is part of a large tray. In every feature, including pattern (fig. 35, *b*), this specimen would have raised no comment if found in a Basket-maker Cave in the San Juan country.

Two-rod-and-bundle Triangular Foundation, Wood-splint Sewing Element (figs. 33, *m;* 97, *c-e;* 98)

Source and Quantity. Upper Gila area—Doolittle Cave; Steamboat Cave; Cave Canyon Cave; Water Canyon Cave;

Cave 2, West Fork; Cave 1, Goat Basin; Mule Creek Cave—3 complete decorated baskets and 13 fragmentary specimens.

Materials. Rods, unpeeled twigs; bundle, shredded yucca leaves (1 fragment with grass bundle); sewing element, flexible wood splints; dyes, red-brown probably from roots of mountain mahogany, black dyes undetermined.

Weave. Uninterlocked stitches around the bundle and rods and through the bundle below; 7 to 16 stitches, 4 to 8 coils to the inch; width of sewing element slightly under to slightly over 1/16 of an inch.

There are commonly no split stitches on the inner or working surface, and only an occasional accidental splitting of stitches on the outer surface. The weave is tight. The rods and bundle are usually concealed on the inside, but not so completely hidden on the outer surface. One basket has the rods and bundles concealed on both faces. In a few instances, where the narrow sewing element is widely spaced, the rods and bundles are exposed on both sides.

Shape, Size, and Decoration. The fragments yield unsatisfactory data but seem to be parts of shallow baskets (not trays) with flaring sides and flat bases. They are too small to indicate the original size and only one bears colored decoration. However, the complete baskets (figs. 97, *c*, 98), which will be described individually, confirm the observations as to shape, furnish a few dimensions, and show decorative motifs.

The decorated basket (fig. 97, *c*) from Site 6, Water Canyon, Upper Gila area, has a flat bottom and flaring sides. The depth is 2 inches; diameter, 4 1/4 inches at the rim. There are 10 to 11 stitches, and 5 coils to the inch. The sewing element is flexible wood-splint, a fraction under to a fraction over 1/16 of an inch wide. It is decorated by alternate and opposed dentate key figures in dark brown and red (fig. 35, *a*).

One decorated basket (fig. 98, *a*) from Site 2a, Cave Canyon, in the Mogollon-Sapillo section of the Gila, is shaped like a small deep bowl with base slightly flattened. The depth, 2 3/4 inches; diameter, 6 inches at the rim. There are 10 to 11 stitches and 5 coils to the inch. The sewing element is flexible wood splint, a fraction under to a fraction over 1/16 of an inch wide. The end of the final coil on the rim is finished by passing the sewing element around it in a figure-eight stitch, which gives the effect of a braid (fig. 34, *b*).

Decoration consists of alternate opposed key and angular figures suggestive of trees or cane cactus. These figures are worked in with the sewing element, dyed dark red and embellished with occasional stitches in black. In 1 case, the weaver made an error in the arrangement by placing 2 tree-like figures together.

The other decorated basket (fig. 98, *b*) from Site 2a, Cave Canyon, in the Mogollon-Sapillo section of the Upper Gila is shallow with flat bottom and flaring sides. Its depth is 2 1/4 inches; diameter, 9 inches at the rim. There are 14 to 16 stitches and 5 coils to the inch. The sewing element is flexible wood splint, a fraction under to a fraction over 1/16 of an inch wide. The rim is frayed, and the method of finishing off the last course of coiling cannot be determined. It is decorated by 4 dentate figures in black, suspended from the rim. In the center of each black figure is a hexagon in red, outlined by undyed stitches. Accurate spacing of the figures and even sewing, especially on the inner surface, shows good workmanship.

Half-rod Foundation, Yucca and Sotol Sewing Elements (figs. 33, *b*; 94, *c*; 95, *d–f*)

Source and Quantity. All from the Hueco area—Chavez Cave, 25 specimens; Ceremonial Cave, 4 specimens.

Materials. Rod, longitudinal half of a round willow-like twig, laid with flat side downward (fig. 33, *b*); sewing element, strips of yucca (*Yucca elata*) or sotol (*Dasylirion Wheeleri*) leaves. The rod, presumably thoroughly wet, was drawn down by the sewing splint so tightly that its flattened surface conformed to the convex top of the coil below. When the awl pierced a half rod thus distorted, it split off a triangular section of the lower edge on both back and front as shown in figure 33, *b*. Often these section, plainly traceable between the stitches, have the appearance of individual strands of a bundle foundation. These show particularly well in figure 95, *d*. The maceration of the wood by stitching and compression has in most cases so altered the half rod that it can easily be taken for a bundle or multiple-reed foundation. Dissection gives the only sure clue to its identification.

Weave. Four to 7 stitches, 3 to 8 coils to the inch; sewing element 1/16 to 1/8 of an inch wide. In joining successive coils, the sewing element encircles the half rod above and pierces deeply the one below. The fabric is astonishingly firm and rigid, and when wet in most cases would have been waterproof.

In 24 of 29 specimens the stitches are interlocked. In some there is no splitting, so that the visible parts of the stitches stand in clear diagonal

rows (fig. 95, *d*). Baskets identical in appearance have come from caves in Coahuila, Mexico. Some show the diagonal rows of stitches as plainly as in figure 95, *d*, while in others the diagonals, though present, are less obvious and the effect is more that of plain checkerweave, as in figure 95, *c*—a specimen with bundle foundation. Coffin also found this weave on a grass-bundle foundation from the Big Bend.[4]

From examples such as the above, in which there are no split stitches, the series ranges up through specimens with increasing proportions of splitting to those containing 100 per cent, as in figure 95, *f*. This is one of 5 intentionally split-stitch fabrics in the half-rod category (fig. 33, *f*). There can be no doubt that the splitting was done to produce an ornamental effect. It contributed nothing to strength. If anything, the unsplit examples, in which each stitch passes through all of the stitch beneath, would have been more substantial than the split ones, where but a portion of the stitch beneath is engaged.

One specimen in this category (fig. 94, *c*) led us for a time to postulate a vertical one-rod-and-splint foundation, because between the stitches, most of them split, a strip of yucca leaf could be discerned on the outer side, lying along the top of the rod. Question arose as to the function of this strip because the stitches of the next coil above were not caught beneath it, but instead reached farther down to pierce the rod. Eventually it was determined that the splint was not an integral part of the foundation, but consisted of the bound-in ends of sewing elements. As the weaver approached the terminus of one sewing strip, she laid the tip of another on top of the rod and caught it down with stitches until the old one was used up. The new one was then warped down, caught through the upper part of the coil beneath, brought up behind and over the current rod. This manipulation is shown, with foundation omitted, in figure 33, *n*. The take-off of the new element was now accomplished so that normal stitching could be resumed.

Shape and Size. Most of the fragments indicate parts of large, shallow baskets. The more tightly woven pieces, some with pitch on the interior, may well have been parts of water containers.

Decoration. No colored sewing elements were used.

[4] Personal information.

Grass or Fiber Soft-bundle Foundation, Sotol Sewing Element (fig. 99)

Source and Quantity. Hueco area—Ceremonial Cave; Chavez Cave—9 fragments and 1 bag

Materials. Bundle, finely shredded grass or yucca fiber; sewing element, strips of sotol (*Dasylirion Wheeleri*) leaves.

Weave. Three to 5 stitches, 3 coils to the inch; sewing element 1/16 to 3/16 of an inch wide.

The bundles are coiled and pulled closely together by interlocked stitches. The fabric is soft and pliable. The bundles are exposed. This technique is essentially the same as that shown in figure 33, *a*, but the bundle is extremely large and the stitches are very widely spaced.

Shape and Size. The bag (fig. 99, *a*) is an inverted truncated cone, whose apex is sewed together instead of having a coiled base. It is 4 1/2 inches in diameter at the rim, 6 inches deep. The fragments, one a tightly coiled base (*b*), suggest large storage containers similar to the Pima granary.

There was no evidence that this type of fabric was used for mats.

Two spherical coiled baskets, 24 and 25 inches in diameter, and another truncated cone-shaped basket, 27 inches in diameter, were found in Kelly Cave on the San Francisco by R. C. Eisele. The larger basket contained 92 pounds of small white beans (*Phaseolus vulgaris* sp.). Both baskets have large, soft grass-bundle coils, 3/4 of an inch to 1 inch in diameter. One is sewed diagonally with stripped yucca leaves and the others with a zigzag alignment of stitches up the sides. In the Hueco area were remnants of hard and soft bundle-grass coiled basketry, but with much smaller coils and with more closely spaced interlocked stitches which are not used on these baskets from Kelly Cave. In the Upper Gila not a specimen in this technique was found. All that can be said, therefore, is that the 3 large baskets are an importation and do not fit into the basketry types from either area. Very likely they are old, but there is also a suspicion that they may be of more recent date and represent a cache of food left by marauding Apaches who infested this section of New Mexico until recent times. However this may be, they should be recorded, since,

if they are prehistoric, they may show contacts with tribes to the west; furthermore, they bear a slight resemblance to the basketry farther south.

Bundle Foundation, Yucca and Sotol Sewing Elements (figs. 33, *a*, *e*, *j*; 95, *a*, *c*; 100; 101, *c*)

Source and Quantity. All from the Hueco area—Chavez Cave, Ceremonial Cave—32 specimens.

Materials. Bundle, sotol leaves shredded to varying degrees of fineness; grass, in most cases fine, but in some nearly the size of a match stick, with ribbed exterior; sewing element, yucca (*Yucca elata*) or sotol (*Dasylirion Wheeleri*), with occasional use of *Martynia* in the rim coil.

Weave. Four to 11 stitches, 3 to 8 coils to the inch; sewing element 1/16 to 1/8 of an inch wide. Of a total of 32 specimens, on 7, the stitches are uninterlocked (fig. 33, *j*); on 17 interlocked (*a*); and on 8, consistently split (*e*).

Fabrics in this group are of widely diverse appearance. Figure 95, *a* so closely resembles coarse-coiled specimens that by stretching a point it could be placed in that classification; (*c*) in visual effect, both of surface and of frayed coil ends, is so like *d* that only dissection revealed that *d* has a half-rod foundation and *c*, a bundle. The miniatures, figure 100, *b–e*, *g*, show crude and careless workmanship which may be accounted for by the assumption that they were intended for offerings and not for hard use. Decoration of the rims of figure 100, *b*, *c*, and *e* was accomplished by the insertion of a few black stitches of *Martynia*.

The basket bottoms, figure 100, *a*, *f*, though now worn and frayed, were of firm, solid construction, closely and neatly stitched.

The small bowl in figure 101, *c* is the finest bit of basketry in the entire collection. In spite of the fact that the foundation is of coarse grass stems, the coils are of uniform width and are drawn so tight by the narrow, skilfully controlled sewing elements that the fabric is as rigid as if carved from wood. There are 7 coils and 11 stitches to the inch, with a sewing element slightly under 1/16 of an inch wide. As a result, the foundation shows plainly between the stitches. The workmanship in the finely woven specimen is somewhat like that in a basket from Coahuila, Mexico, now in the Peabody Museum, which has a coarse grass-bundle foundation.

Shape and Size. Large, shallow baskets; a few with pointed bottoms; miniatures, one (fig. 100, *e*) of carrying-basket form; and at least one almost straight-sided bowl (fig. 101, *c*); diameter, 5 3/4 inches.

Decoration. On miniatures only. A few black *Martynia* stitches in the rim.

DISCUSSION OF COILED BASKETRY

The significant facts brought out by the study of our collection of close-coiled basketry are presented graphically and tabulated in figure 33.

The first point to impress one is that on the basis of techniques and materials the basketry falls into 2 rather distinct groups, one characteristic of the Upper Gila and the Mimbres, the other of the Hueco area.

Of a total of 128 specimens—some represented by more than 1 fragment—19 are Upper Gila-Mimbres, 109 Hueco area.

In the 19 Upper Gila-Mimbres specimens only 3 techniques appear. There are 17 examples of two-rod-and-bundle triangular foundation with uninterlocked stitches, 16 sewed with wood splints, 1 with yucca. There is 1 instance of wood-sewed, one-rod sifter coiling (multiple stitch-and-wrap, interlocked) and 1 specimen of bundle-with-rod-core foundation, stitched with yucca, uninterlocked.

The 109 Hueco specimens group themselves as follows: two-rod-and-bundle triangular foundation, 26 examples—22 sewed with yucca splints and 4 with wood; 23 with uninterlocked stitches; 3 with interlocked (2 of them split). Bundle foundation (widely varying in texture), 32 examples, all yucca sewed—7 with uninterlocked stitches, 17 with interlocked, and 8 with split. Half-rod foundation, 29 examples, all sewed with yucca—24 interlocked and 5 split. Rod-with-lateral-bundle, 14 examples, yucca sewed—4 uninterlocked, 10 split. One-rod foundation, 5 specimens, all split stitch—4 sewed with yucca, 1 with wood. In 4 cases the stitches encircle 2 rods; in 1 they pierce the rods. Bundle-with-rod-core, 3 examples—2 sewed with wood, 1 with yucca, stitches uninterlocked.

Thus grossly there may be recognized 6 techniques in the Hueco basketry. But there are 2 that we regard as esentially the same—bundle foundation and half-rod. Of the 32 bundle-foundation specimens, 29 are from Ceremonial Cave, 3 from Chavez. Of 29 half-rod examples, 5 are from Ceremonial Cave, 24 from Chavez. This

distribution shows the frequency of occurrence to be reversed in our 2 major Hueco sites. We regard these 2 kinds of foundation as local variations, dependent upon predilection, or more probably upon materials available, of the same basic plan of construction. Classing these 2 together reduces the number of the Hueco techniques to 5 and brings out the combined half-rod-bundle class with 61 examples, as the predominant, or, it might be said, standard Hueco foundation.

There is only 1 technique—two-rod-and-bundle—that is common both to the Gila-Mimbres and the Hueco. It occurs in 17 of 19 specimens from the former and in 26 of 109 in the latter. There is but 1 specimen of a Hueco technique among the Gila-Mimbres specimens, an example of bundle-with-rod-core, yucca stitched. The third technique present among the Gila-Mimbres specimens—sifter coiling—has no suggestion of a parallel among our Hueco basketry.

The sewing splints in Gila-Mimbres specimens are wood in 18 cases, yucca in 1. In those from the Huecos, 7 are of wood and 102 of yucca. (Here as elsewhere in general discussion we class yucca and sotol as one.) The wood-splint baskets are of smooth texture with stitches of uniform width that impart a softness and pleasing finish to the fabric. In contrast the roughness of the leaf in the yucca-sewed fabrics gives them a surface that is harsh and sandpapery to the touch. The yucca basketry impresses the eye as more open than the wood, because more of the foundation shows between the stitches, especially if they are split. But for actual strength and rigidity, the yucca basketry surpasses the Gila-Mimbres wood-sewed class, as well as Basketmaker fabrics from the San Juan.

Too much significance should not be attached to the difference in sewing materials in separating basketry of the Upper Gila from that of the Hueco area. The wide use of yucca in specimens from the Hueco area is most probably due to the fact that yucca is very plentiful in that area while willow and comparable woods are scarce.

On 18 of the 19 Gila-Mimbres specimens the stitches are uninterlocked; among the 109 from the Hueco area, we list 37 as uninterlocked, 44 as interlocked, and 28 in which all or nearly all are split. In interlocking without splitting, the entire width of splint in 1 stitch passes diagonally through the entire width of a stitch in the coil below. In splitting, the entire width of 1 stitch passes diagonally through 1 side of the stitch in the coil below which the awl has split—the left or the right, depending on the direction of work. Thus the split stitch is inherently interlocked. Hence split-stitch fabrics should be placed in the interlocked class, giving us for the Hueco 72 interlocked as against 37 uninterlocked.

Direction of work in 18 of the 19 Upper Gila-Mimbres specimens is from right to left and in one, the reverse. In the Hueco area specimens, 100 were sewed from right to left and 9 from left to right.

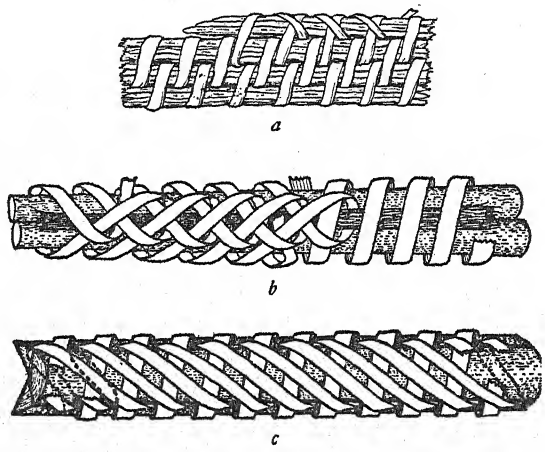


FIG. 34. Basket rims. *a*, end finish on bundle-foundation basket; *b*, end finish on two-rod-and-bundle foundation basket (false braid at rim termination); *c*, rim technique of half-rod foundation basket (2 strands sewn synchronously from left to right). *a*, *c*, Ceremonial Cave; *b*, Site 2a, Mogollon-Sapillo.

Rims are present on too few of our specimens to throw much light on rim finish. Three Gila specimens have a self rim; that is, the terminal coil is sewed in the normal fashion with the same material as the rest, suggesting that the self rim may be taken as customary for the Gila. On one of the three, the end of the coil is done in false braid. Not one of the Hueco Mountain specimens retains the rim termination, but a few exhibit bits of self rim done usually in *Martynia* instead of yucca leaf. One fragment has a finish that we have not found on record elsewhere. Over a self rim 2 sewing splints were worked along at the same time from left to right. Each one emerges on the outer side after interlocking with a stitch of the self rim and is carried forward 2 normal stitch intervals before its next insertion

on the inside. In this way it crosses and hides three of the self rim stitches (fig. 34, *c*). The visual effect of this sort of binding stitch is that of closely spaced, long diagonals that run in but one direction across the top of the rim of the basket.

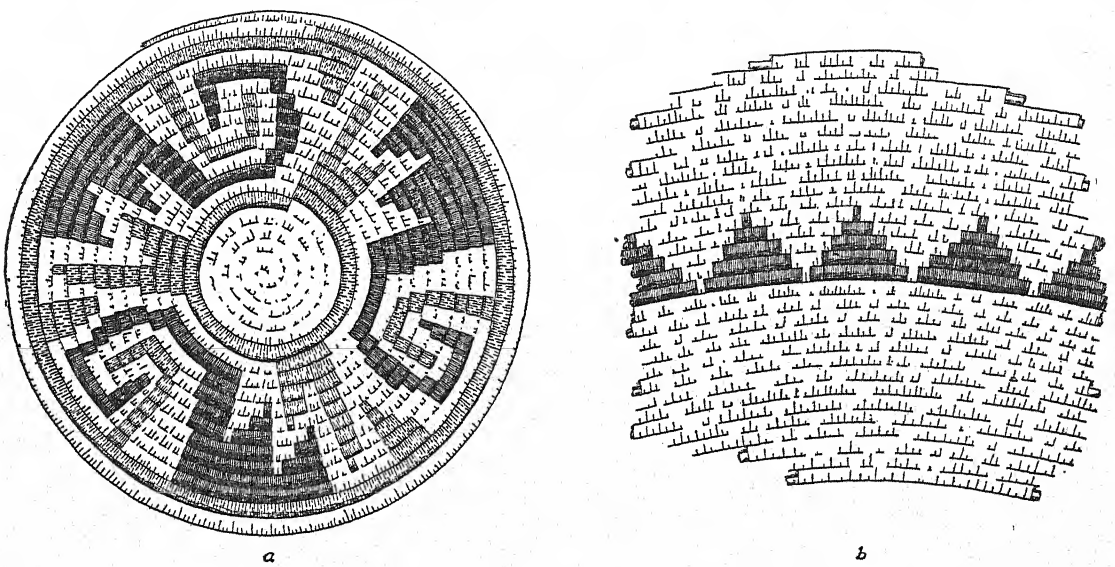
Most of our specimens are so tattered that it is not apparent just how the ends of the sewing elements were manipulated. However, one generality can be advanced. The Upper Gila-Mimbres method is the same as that of the San Juan Basket-makers. (Shown with foundation omitted in fig. 33, *o*.) The new splint was drawn through until it was flush with the work surface, and there it remained as a visible stub (right side in the drawing). The end of the used-up splint was either clipped off flush on the non-work surface (as at the left) or folded in, carried forward and lashed down by one to several stitches of the new splint (as at the right).

The same plan was followed in some of the Hueco specimens, but in that area the more frequent treatment seems to have been that shown in figure 33, *n*. Some distance before the old splint was used up, a new one was laid along the top of the foundation unit and bound down by a number of stitches of the old splint before it was brought out, caught through the top of the foundation of the coil below, thereafter to become the current sewing element.

In the Upper Gila baskets colored decoration was of frequent occurrence. To judge from specimens at hand, it often was done in 2 colors. The black and red patterns on our 3 best specimens are shown in figure 35, *a* and figure 98. And on the basket bottom in figure 97, *e* there is the beginning of a 2-color design.

In the Hueco and Big Bend areas there is a dearth of baskets with colored sewing elements, and in the few reported cases the designs are simple. At least three of the known examples from the Hueco are wholly in the Basket-maker-Pueblo tradition. One is our large fragment from Chavez Cave, the black design on which, done with dyed splints, is shown in figure 35, *b*. The other two are from the cache of 4 from Bishop's Cap,[5] which is across the Rio Grande and southeast of Chavez Cave.

One (Hough's pl. 2) has 4 sets of heavy black zigzag lines, done presumably in devil's claw, radiating from the center and broadening toward the rim. The second (Hough's pl. 3, fig. 2) carries "at wide intervals small sections vertical and horizontal in black, the vertical extending down from the rim. . . . The design appears to be in *Martynia*."



a *b*

FIG. 35. Basketry decoration. Two-rod-and-bundle triangular foundation, wood-splint sewing element. *a*, Water Canyon Cave (Upper Gila area); *b*, Chavez Cave (Hueco area).

[5] Hough, 1932.

All three of these decorated specimens are on two-rod-and-bundle triangular foundation, ours and Hough's second are sewed with wood splints, his first with yucca, stitches uninterlocked.

Several other examples of colored decoration are known from the Hueco-Big Bend area. In Ceremonial Cave we obtained 2 miniatures or basket bottoms, one made entirely in black from *Martynia*, the other showing the start of a design in the same material. In a disk from Cave 7, Hueco Mountains, which is the first 3 coils of an unfinished basket (fig. 104, *b*) *Martynia* is combined with yucca sewing elements. And on a few fragments where bits of the rim remain the terminal coil was sewed with *Martynia*, but whether for ornamental effect or to attain a smoother rim, there is no way of telling.

Howard mentions a basket from the Guadalupe Mountains decorated with "a design in triangular elements."[6]

Our baskets and fragments from the Upper Gila-Mimbres give evidence only of small containers of bowl or tray shape. The largest complete specimen is 9 inches in diameter. While undoubtedly some larger than this were made, there is nothing to suggest that in the region under consideration baskets of such great size as those common in the San Juan and in the Hueco-Big Bend were ever manufactured.

Our largest complete basket from the Hueco area is 11 1/2 inches in diameter—and deep, with rather straight sides. However, numerous fragments are from much larger bowls and trays, and specimens found by others provide data concerning the size range. In the cache from near Las Cruces described by Hough[7] there were 3 baskets of the shapes in question. One 9 1/2 inches in diameter and 3 1/2 inches deep; another, distorted, with diameters of 16 and 19 1/2 inches and a depth of 6 1/2 inches; the third, oval in form, 16 1/4 by 17 3/4 inches and 5 3/4 inches deep.

East of the Huecos at Burnet Cave in the Guadalupe Mountains Howard found with burials 4 tray baskets 12, 12, 21 1/2, and 22 3/4 inches in diameter.[8] Livingston from Carlsbad, New Mexico, illustrates a deep-coiled basket and a large tray presumably from the same neighborhood.[9]

Smith gives the dimensions of 2 bowl-shaped coiled baskets from the northern part of Brewster County, Texas, as 9 inches deep and 21 inches in diameter.

Among our Hueco material are several pointed basket bottoms, some of them coated with pitch. Presumably these are parts of deep water jars—a form that would have been almost essential in a country so arid.

One shape of coiled basket that is conspicuous in San Juan Basket-maker culture is the burden basket. We found no fragments in the Gila of a shape or size that would suggest, even remotely, its presence there.

Some of the larger Hueco fragments could well have come from carrying baskets, but not enough remains of any one to prove it. Two elliptically coiled bases from Ceremonial Cave would seem most likely once to have belonged to burden baskets, but even in this case we must be cautious, since the bottoms of both bowls and trays sometimes were made in the same way.

In the Bishop's Cap specimens described by Hough there is 1 carrying basket.[10] The following details were given us by Dr. A. Wetmore, of the United States National Museum. The ovate bottom is flat, similar to those from Ceremonial Cave, with diameters of 4 1/2 and 7 1/2 inches. The sides are built up in conformance with this outline. Diameters at the present top are 14 and 18 inches, and the height 13 1/2 inches. The frayed rim shows that it was once at least one and perhaps several coils higher. On the authority of Weltfish[11] the technique is two-rod-and-bundle, uninterlocked stitches, wooden sewing splint.

Howard reports the finding in 1920 of "a cone-shaped carrying basket" by some young men in Burnet Cave on the east side of the Guadalupe Mountains. The form, without dimensions or technique, was all that he was able to record, since the basket had disappeared.[12]

It now remains to discover, if possible, to what cultures our 2 distinct groups of basketry, the Upper Gila-Mimbres and the Hueco, show a relationship. The first conclusion comes without groping. Upper Gila-Mimbres basketry is 100 per cent Basket-maker–Pueblo. Among out total of 19 specimens, there is but one in a technique that seems foreign to the north—bundle-with-rod-

[6] Howard, 1935, p. 69.
[7] Hough, 1932.
[8] Howard, 1935, pp. 68–69.
[9] Livingston, 1932, pp. 9–11.
[10] Hough, 1932, pl. 3; fig. 1.
[11] Weltfish, 1932, p. 32.
[12] Howard, 1932a, p. 9.

core, uninterlocked, yucca sewing element. Yet even this technique, with wood instead of yucca sewing splint, is recorded in 2 instances from the heart of the Basket-maker country—one from Du Pont Cave, Utah[13] the other from Allan Canyon, Utah.[14]

The 16 two-rod-and-bundle, uninterlocked, wood-sewed specimens worked from right to left are representative of what was always the most commonly practised technique in the Basket-maker-Pueblo area. The identity is further confirmed by the presence of balanced red and black designs, the manipulation of the ends of the sewing splints, and rim finish.

Sifter coiling, represented in our collection by 1 specimen, though not plentiful, is an integral component of basketry from the San Juan and neighboring areas. Thus the Upper Gila-Mimbres basketry is definitely placed.

Now where does the Hueco material fit in?

Foundations. Hueco foundations that occur in the Basket-maker–Pueblo area are as follows: two-rod-and-bundle, predominant in the north, 26 of 109 examples in the Hueco; bundle, very rare in the north, 32 of 109 examples in the Hueco; one-rod, frequent but not abundant in the north, 5 of 109 examples in the Hueco; bundle-with-rod-core, very rare in north, 3 of 109 examples from the Hueco.

There are 2 Hueco foundations so far unknown in Basket-maker–Pueblo specimens: half-rod (29 of 109 specimens), and rod-with-lateral-bundle (14) of 109 specimens). Also our coarse coiling is not known to occur among Basket-maker–Pueblo material.

Sewing Material. In the north wood with extremely few exceptions. In the Hueco almost wholly of yucca (102 of 109 specimens). However, this can be accounted for by difference of materials most readily available.

Stitching. *Uninterlocked.* Standard for the north. Exceptions very rare. In the Hueco 37 of 109 specimens.

Interlocked. Extremely rare in the north. In the Hueco 44 of 109 specimens.

Consistently Split. One recorded example from the north (Du Pont Cave). In the Hueco 28 of 109 specimens. Since split stitches are inherently interlocked, the proportion of uninterlocked to interlocked stitches is 37 to 72. The facts to be derived from all of this are that foundations frequently employed in the Hueco are unknown in the Basket-maker–Pueblo area; that others commonly used in the Hueco are rare in collections from the north; and that the standard Basket-maker foundation occurs in less than one-fourth of Hueco specimens. In the matter of sewing, uninterlocked stitches are all but universal in Basket-maker–Pueblo basketry, while interlocked stitch specimens constitute 66 per cent of the total in the Hueco. In other words the ranking type of Basket-maker–Pueblo basketry is two-rod-and-bundle, with uninterlocked stitches; that of the Hueco, either half-rod or bundle (which we regard as structurally the same) with interlocked stitches, of which splitting is a very conspicuous feature. The only tie of any strength at all between the Hueco and Basket-maker basketry would seem to be the presence of about 20 per cent of two-rod-and-bundle with uninterlocked stitches in the former.

The only other direction in which to look for a comparison is toward the south and southeast. From the Hueco area the use of two-rod-and-bundle triangular foundation basketry with bifurcated stitch extends to the east side and southern point of the Guadalupe Mountains in New Mexico and Texas as is shown by Howard.[15] Specimens with split stitches around multiple-reed bundle foundation were recovered by Howard in the Guadalupes and by Coffin farther south in the Big Bend.[16] Coffin also found bifurcated stitches on the grass-bundle foundation, but in addition an unpublished photograph of his shows a bundle foundation over which the broad stitches did not split each other. According to Setzler, the reed-bundle foundation with bifurcated stitches came from sites which he excavated along the Pecos River and in the western Big Bend, but he states that to the west the most characteristic type is the grass bundle with bifurcated stitches.[17] Smith illustrates a basket fragment from the general Big Bend country which has either a reed-bundle or a two-rod-and-bundle foundation with split stiches.[18] The grass bundle with bifurcated stitches has its counterpart in a specimen from Coahuila, Mexico, which is now in the Peabody Museum.

[13] Nusbaum, 1922, p. 96.
[14] Weltfish, 1932, p. 16.
[15] Howard, 1930, pl. XXVIII, 4, p. 197. Also personal information.
[16] Coffin, 1932, p. 38.
[17] Setzler, 1935, p. 106.
[18] Smith, 1932, pl. 12, no. 28.

Howard discovered the reed bundle held by interlocked stitches in the Guadalupes,[19] while at the mouth of the Pecos River Pearce and Jackson,[20] also Martin, made similar finds.[21] Setzler reports a bundle foundation with interlocked stitches from the Pecos River district, where he states that it is predominant, although appearing to the west in the Big Bend.[22] Still farther south Coffin found yucca-splint bundle basketry sewed in this manner. The split-stitch basketry appears in the lower Pecos River district, and it can be said that the bifurcated stitch on either rod or bundle stands generally as the earmark for the basketry of the extreme western Texas culture. Coiling of the hard or soft grass-bundle foundation prevails in western Texas and in Coahuila, Mexico. Although the stitching is generally finer and the intentional splitting of the yucca sewing element is not so common in the latter place, yet there appear in Coahuila, western Texas, and in the Hueco area the vertically open-spaced wide yucca stitches around the bundle, a feature which seems to connect the Hueco Mountain district with Coahuila to the southeast.

Among variations in basketry weaving not seen in the Upper Gila and Hueco areas should be mentioned the plain twined samples from Brewster County[23] and from the lower Pecos River in Texas;[24] also from the latter district are the openwork twined specimens.[25] These techniques, although in the minority, must be noted as they seem to be affiliated with the apparently localized bundle foundation and interlocked stitch found there.

In view of the above, if we grant to the Hueco basketry a 25 to 30 per cent Basket-maker–Pueblo relationship, most of the other 70 to 75 per cent may be allocated to the south and southeast. Whether future discoveries will show the Hueco to have been the heart of a basketry province or to have been marginal to dominant centers elsewhere, time alone can tell. But what impresses us as the most reasonable present conclusion is that the Hueco Basket-makers retained only the most basic techniques of their forebears and took over from the peoples of the Pecos, the Big Bend, and Coahuila the non-Basket-maker plans of construction and manipulations so evident in their basketry.

MISCELLANEOUS BASKETRY

Plain Checkerweave Basketry. In the Hueco area the plaited basketry is all plain checkerweave, over-1-under-1. A complete basket and 3 fragments from 2 sites will be separately described, as there are some slight variations in handling the material.

The complete specimen (figs. 36, 101, *a*) was found in Cave 1, Hueco Mountains, at the right of the adult skull.

Materials. Wide sotol (*Dasylirion Wheeleri*) leaves with barbs removed from their edges; hoop around the rim of the basket, bent twig; sewing element, 2-strand yucca-fiber cord.

Weave. This basket is the plain checkerweave, over-1-under-1. At the rim the standing leaves are bent out and down, 1 leaf being secured under the first horizontal element and the next leaf passing over the first and under the second horizontal element, and so on. The ends of the leaves are then cut off. This forms a series of loops along the selvage which are bound and made tight by 2 cords, one of which passes through the loops while the other first below it is stitched over and under the vertical elements. A hoop is attached to the selvage by a third cord which is buttonhole stitched around the cords in the selvage. The ends of the buttonhole stitching are tied off with a square knot where they meet. A bail is formed by the surplus of the threaded and sewed selvage cords which are given an overhand knot as they emerge on opposite sides of the rim and are brought up and tied together with a square knot at the top of the bail. When this knot was tied, another strand was laid in it to reinforce the bail and the cord passed through the basket sides at a point below the selvage, making 4 strands in all. The ends of this cord were then tied together with a square knot.

[19] Howard, 1930, pl. XXVIII, 2.
[20] Pearce and Jackson, 1933, figs. 22 and 23.
[21] Martin, 1933b, pl. XIX, no. 4.
[22] Setzler, 1935, p. 106.
[23] Setzler, 1933, fig. 55*b*.
[24] Pearce and Jackson, 1933, pl. XXIV.
[25] Pearce and Jackson, 1933, pl. XXIV. Martin, 1933b, pl. XIX, no. 5.

Shape and Size. The square, flat base of the basket measures 8 inches by 8 inches; vertical sides, 6 inches high; elliptical opening, 3 1/4 inches wide, 7 1/2 inches long.

The 3 fragments of plain checkerweave, two of them parts of a basket base (one shown in fig. 101, *b*) came from Cave 1 and Cave 6 in the Hueco Mountains.

Material. Strips of *Yucca macrocarpa* leaves and narrow sotol (*Dasylirion Wheeleri*) leaves with barbs left on the edges of the blades.

There are no indications of colored elements either on the complete basket or on the fragments.

In the Big Bend Coffin found 3 forms of this type of basketry: one, a small square pouch made from a plaited sotol mat which was sewed together and not woven as a whole;[26] another, a small cylindrical basket 4 1/2 inches in diameter, the photograph of which shows that wide sotol leaves were used;[27] and the third form, tray-sifter baskets which, from a photograph, are much like the loosely woven sifter-basket fragment just described.[28]

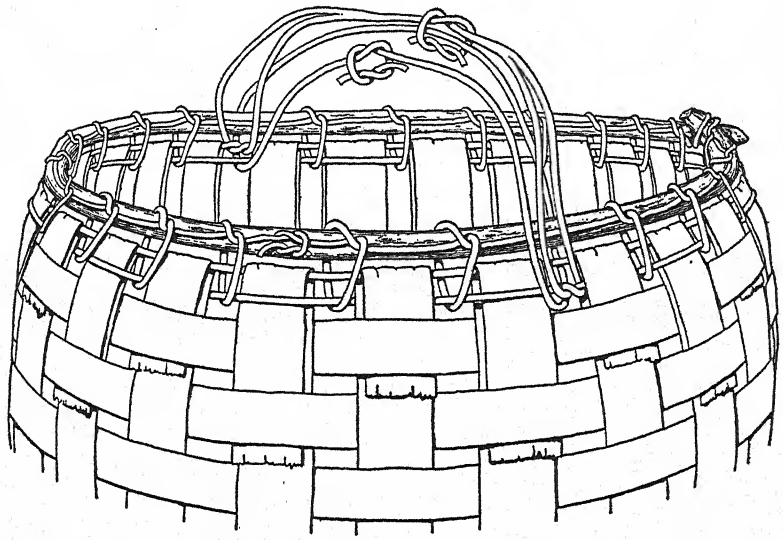


FIG. 36. Top of plain checkerweave basket with cord bail and cord reinforced selvage, Cave 1, Hueco Mountains.

Weave. Each element consists of 2 strips or whole leaves laid one on top of the other. The weave starts at the basket base with the tapering ends of the leaves. The selvage on 1 fragment of a sifter basket is reinforced by an extra leaf strip introduced along that course, which is held by the opposing 2-ply weaving elements bent over the edge and brought back into the fabric as the next course.

Shape. The base fragment may have come from a basket with vertical sides, somewhat rectangular, similar in form to the one from Cave 1, just described, and to a small basket about 5 inches square from Ceremonial Cave, now in the R. B. Alves collection, El Paso.

[26] Coffin, 1932, p. 36 and fig. 4.
[27] Coffin, 1932, p. 37.

Oblique Twilled Basketry (fig. 102, *b*)

Source and Quantity. Upper Gila area—Mule Creek Cave, 1 fragment of basket rim.

Material. Bear grass (*Nolina microcarpa*); for the hoop around the rim, hardwood twig.

Weave. The weave is oblique twilling, over-3-under-3. At the rim the elements are divided into clusters and bent out and down over a wooden hoop. These clusters are held in place by strips of bear-grass twine, stitched through the fabric below the hoop. The loose ends have been given a half turn and plaited into the succeeding free elements to the left, forming a braid below the

[28] Coffin, 1932, p. 38.

hoop identical with the selvage on the twilled mats. The sewing elements vary from 3/32 to 1/8 of an inch wide.

Size and Shape. This fragment, the mouth of a jar-shaped basket, is 4 inches in diameter, but from it we have no means of determining the height or greatest diameter of the finished basket.

Hough found a complete basket of this type in Bear Creek Cave on the Blue River, Arizona, and also a rim fragment from Tularosa Cave in the Tularosa Valley in New Mexico.[29] With the exception of a more elaborate "false braid," as he terms the band below the rim, rather than the turning of the loose ends to form a simple plaited selvage, the technique is the same. The sites mentioned by Hough are all in the Upper Gila area, and it is not surprising that baskets of this type should be found in other parts of the same area.

The plaited basketry of the Upper Gila and Hueco areas are entirely different. The twilling, which is strongly Puebloan, belongs in the Upper Gila, and the plain checkerweave, on the basis of associated finds evidently Basket-maker, is confined to the Huecos. However, both the coarse-checker and fine-twilled techniques are found in the Pecos-Big Bend area.

Leaf Basket (fig. 102, *c*)

Source and Quantity. Upper Gila area—Cave 1, Goat Basin, 1 specimen.

Material. Yucca macrocarpa.

Weave. A strip of the plant leaf, 1 1/2 inches wide, is folded at the base and held by a wrapping of fiber. The leaf is then split into 20 elements, forming the ribs of the basket. About 2 1/2 to 3 inches from the end each rib is bent down and back into the basket, then turned out and around itself toward the right. The same manipulation of each succeeding rib holds the ends of the preceding ones in a bundle and forms a stiff selvage around the rim. As a means of suspension a loop is formed by light yucca strands, tied around 2 of the ribs below the selvage.

Perhaps because of inexperience or carelessness, "granny" knots, instead of regulation square knots, were used to join the ends of the strands wrapped around the base and in the loop handle.

Size. The diameter at the rim is 3 inches; depth, 3 inches; length, including the base, 5 inches.

This small vase-like container is a near duplicate of the Basket-maker III "Yucca-top Basket" found by Guernsey in Segi Canyon.[30] Although it lacks the plant-stalk base, it resembles Guernsey's specimen in shape and weave; and the fact that it was found in association with fur cloth and a dart foreshaft renders it practically certain that it too is a Basket-maker product.

Basket-like Leaf Container (fig. 102, *d*)

Source and Quantity. Upper Gila area—cist in the east tunnel of Mule Creek Cave, 1 specimen.

Materials. Body and twining elements, yucca leaves, hoop, twig.

Weave. The tapering ends of narrow strips of yucca leaves are tied in a bundle at the base with a wrapping of the same material. Above this are 4 equally spaced courses of twined yucca threads. Inside the container near the top is a twig hoop, the ends of which are lashed together with yucca. The hoop is held in place along the second course of twining by a whipping of yucca and the twined elements. The ribs of this basket are left free at the upper end, with no indication of its having had carrying loops.

Shape and Size. This bag-like container measures 5 inches in diameter; 12 inches in length.

Basket-like Leaf Container (fig. 102, *a*)

Source and Quantity. Upper Gila area—cist in east tunnel, Mule Creek Cave, 1 specimen.

Materials. Body, bear-grass leaves; twining elements, shredded and loosely twisted strips of yucca leaves; tie strings, 2-strand yucca-fiber cord.

Weave. The leaves are all laid in the same direction with the butts turned up on the inside. There are 6 courses of twined weaving holding the leaves in place, the last course passing around their upturned ends, firmly binding the series of loops thus formed. Part of a heavy strand of shredded yucca passes through the loops, presumably to draw them together. Pieces of cordage attached near the top and at the base might indicate that the container was wrapped either around articles to be stored or transported, and secured by these tie strings, or that the twined cross-strands had been tied together to form an open-end basket with the extra strings as additional reinforcement.

[29] Hough, 1914, pl. 17, no. 3; fig. 179, p. 88; pl. 16, no. 1.

[30] Guernsey, 1931, pl. 11, *b–d;* p. 78.

Size. The circumference at the center, with the edges together is 18 inches; circumference at base, 9 inches; length, 19 inches.

The leaf basket and the basket-like leaf container just described were found together in Mule Creek Cave in a cist containing part of a fur-cloth blanket, a Type 11 sandal, and a tule mat. Both specimens are reminiscent of the "yucca-top" baskets illustrated and described by Guernsey.[31]

Ring Basket (?) (fig. 103, *e*)

Source. Hueco area—Chavez Cave.

Materials. Hoop of 2 bent branches, 1/2 an inch in diameter, with ends lashed together at sides with 2-strand fiber cord; weaving elements, bear-grass leaves.

Weave. From the few strands in place, it may be seen that the weaving is coarse.

Shape and Size. Elliptical frame, apparently for a shallow basket, 7 1/2 inches wide at center and 10 inches long.

This may be the remains of a ring basket, or winnowing tray. It is the only specimen found either in the Hueco area or in the Upper Gila that calls to mind the Pueblo ring basket with twilled plaiting. Fragments of small twigs bent in circular form were found, but not in sufficient quantity to indicate that the ring basket was much in use. Hough illustrates a square tray basket with rod rim and twilled filler from Bear Creek Cave in the San Francisco district.[32]

Carrying Basket (fig. 103, *a*)

Source and Quantity. Hueco area—Ceremonial Cave, 1 fragment of a miniature basket.

Materials. Wooden rods, 1/4 of an inch in diameter; wefts, strips of sotol (*Dasylirion Wheeleri*) leaves.

Weave. Wrapped wood; 2 bowed rods, crossed and tied with strips of leaves at the bottom, used as warps; wefts of split leaves joined as a single strand, the end of which is tied at the bottom and wrapped once around each rod; coiling continues from the bottom toward the top of the basket.

Shape and Size. The basket is cone shaped. The rod on 1 side is 14 inches long.

At Bear Creek Cave on the Blue River, tributary to the San Francisco, Hough found a miniature basket of wrapped weaving with yucca-leaf splints for rods.[33] Our specimen from Ceremonial Cave, although the weaving element is of split sotol leaves instead of cord, is similar, in miniature, to the Mohave carrying basket described by Mason.[34] We found no large assembled frames suitable for carrying burdens, but it is probable that they were used in the Hueco Mountains, because we recovered 2 sets of heavy yucca withes from Ceremonial Cave (fig. 103, *b*, *c*) and another of willow twigs from Chavez Cave (*d*). Rods inserted through the heavy wrappings of these withes would form a tripod serviceable as a framework for a burden carrier.

MATTING

Tie-twined Grass-bundle Matting (figs. 105; 108, *b*)

Source and Quantity. Specimens confined to the Hueco area—Chavez Cave; Ceremonial Cave; Cave 5—1 section of a mat and 4 small fragments.

Materials. Bundle, small straight sacaton (*Sporobolus Wrightii*) seed stem ends, also a soft bunch grass, pulled by the roots; binding element, twisted sacaton blades, also strips of *Yucca macrocarpa* and *Dasylirion Wheeleri* leaves.

Weave. The bundles are held by twined strands or by tie-twining, i.e., strands pass around the bundle and are tied with an overhand knot before the succeeding bundle is laid in. In the specimen with bunch-grass foundation (fig. 108, *b*) the courses of binding elements are 2 inches apart, and the bundles are from 3/4 of an inch to 1 inch in diameter. In those with sacaton foundation the courses of binding elements are 2 to 5 inches apart and the bundles are compressed from 3/8 to 1/4 of an inch in diameter. In the large fragment of a sacaton mat (fig. 105) the first course of binding elements occurs 6 to 8 inches from either side with no selvage on these edges. No selvage is on the ends except that formed by tying off each set of binding elements to secure the bundles.

Size. The remaining portion of the mat is 43 1/2 inches wide and 25 inches long; originally perhaps double the above length.

[31] Guernsey, 1931, pl. 11; p. 78.
[32] Hough, 1914, pl. 17, no. 1; pp. 88, 89.
[33] Hough, 1914, fig. 318, p. 123.
[34] Mason, 1904, pl. 17; fig. 13, p. 230.

This mat was found below a thick bed of fine grass in a sleeping-pit along the back wall of Cave 5, Hueco Mountains. Apparently, it was used as a container in transporting the bedding or in shifting it from place to place in the cave.

The tie-twining technique occurs sporadically over a wide spread area in the Southwest. Coffin mentions pieces of tie-twined fiber from Bee Cave Canyon in the Big Bend.[35] One of his photographs shows a fragment of grass-bundle matting with the bundles spirally wrapped with a fiber strand before being bound together with the tie-twined yucca-fiber strands. At Bear Creek Cave on the Blue River (San Francisco drainage), Hough found decayed rush mats assembled with tie-twined cord.[36]

In the Peabody Museum are 3 fragments from the Marsh Pass region of northeastern Arizona. The first, with bunch-grass bundle, is tie-twined with yucca-leaf strips, 4 1/2 inches apart. This specimen, from a plaza in the center rear of the cave, Cliff House No. 2, Sayodneechee Canyon, was collected by Kidder and Guernsey in 1914. The second, part of a tule rush mat with braided selvage, has tie-twined fiber cords spaced 5 inches apart, accompanied Burial 2, Cave 1, Middle Branch, Segi Canyon. Guernsey, who collected the specimen in 1920, informed us that it belongs in the Pueblo I period. The third, part of another tule mat with braided selvage, has tie-twined fiber cords spaced 4 1/2 and 5 inches apart. It was collected by Guernsey in 1917 at White Dog Cave, a predominately Basket-maker II site with only slight evidence of visits by the Pueblo. From Cave du Pont, a pure Basket-maker II site, near Kanab in southern Utah, northwest of Marsh Pass, Nusbaum reports tie-twining in which bunch grass pulled up by the roots, grass stems, shredded juniper bark, mashed yucca leaves, corn-husks, and cat-tail rushes were used for the bundles.[37] At present there is no evidence that tie-twined matting was made subsequent to the Pueblo I.

Threaded Rush Matting (Fig. 106).

Source and Quantity. Upper Gila area—bear grass-lined cist in the east tunnel of Mule Creek Cave, 1 mat.

Materials. Body, rushes; sewing elements, yucca fiber cord.

Weave. Two-ply fiber cords pierce the rushes which make up the body of the mat. At either end is a 3-strand braid of doubled rushes. The courses of cord, 2 to 3 1/2 inches apart, are threaded back and forth through the rushes and braids along the fabrics. The loops formed at the ends of the mat pierce the braids, holding them in place as an end finish. The rushes are gathered in small clusters along the side edges and tightly bound with a double row of twined cords for a selvage, giving the effect of a chain stitch on the surface. The rushes are then trimmed leaving a secured edge, and the corners are secured by tying the twined side cords to the end braids.

Size. Length, 60 inches; 1 complete sewing element broken away from the side indicates the original width of 65 inches.

Decoration. The twined cords on the edges are dyed a brick red.

Hough found threaded rush matting with braid end finish in Tularosa Cave farther up the San Francisco. The selvage differs from that of the Mule Creek Cave specimen in that the trimmed rushes are bent back and held by a single course of twined cords.[38] Coffin describes matting from the Big Bend made by threading grass blades in the same manner.[39] Guernsey shows Pueblo I rush matting with braid end finish, twined cord warps and selvage from Cave I, Segi Canyon.[40]

No tule matting was found in the Huecos, and so far as can be learned, none appeared in the Big Bend caves. The Coffin grass specimen is threaded, but apparently matting sewed in this way is preponderantly a northern trait of the Pueblo periods.

Checkerweave Matting (fig. 107, *a*)

Source and Quantity. Hueco area—Ceremonial Cave, Picture Cave; Cave 6—6 fragments.

Material. Unsplit sotol (*Dasylirion Wheeleri*) leaves with barbs removed or left on the edges of the leaf.

Weave. The weave is the plain checker, over-1-under-1. The selvage was formed by bending a leaf at the edge and bringing it back as the next element across the fabric. One specimen with this side selvage shows the end secured by strips of *Yucca macrocarpa* leaves twined around the elements.

[35] Coffin, 1932, p. 43.
[36] Hough, 1914, p. 88.
[37] Nusbaum, 1922, fig. 13, *b;* pls. L–LIV; pp. 98–102.
[38] Hough, 1914, fig. 178, p. 87.
[39] Coffin, 1932, fig. 3; pl. XI; p. 36.
[40] Guernsey, 1931, pl. 58, *a*.

Size. No complete mat.

Howard found the narrow-element twilled weave and unsplit sotol leaf in checkerweave matting on the east side of the Guadalupe Mountains.[41] Coffin and Setzler report the same technique from sites in Brewster and Presidion Counties in the Big Bend country.[42] Unpublished photographs of specimens found by Coffin in Bee Cave Canyon show split and whole sotol leaves used in this way; the narrow elements producing a smooth, tight fabric, while the checkerweave of whole leaves, usually with barbs on the leaf edges, is more open. Coffin's complete mats are small, 2 by 4 inches, 3 3/8 by 5 inches, and 7 by 10 3/4 inches. Hough illustrates twilled matting apparently of split bear-grass leaves, from Bear Creek Cave on the Blue River, but says that none came from Tularosa Cave on the San Francisco.[43]

Neither Hough nor the authors found checkerweave in the upper Gila, all cross-weaving in grass and rushes being twilled work. On the other hand, we found nothing but the coarse checkerweave in the Heuco area, while to the east, in the Guadalupe Mountains, Howard discovered both checker and twilled, as did Coffin and Setzler in the Big Bend. Both coarse checkerweave and fine twilling have been reported from Mexico south of the Big Bend. Still farther south in Coahuila specimens from burial cists, now in the Peabody Museum, are mostly of twilled weave, with but 1 fragment of coarse checker.

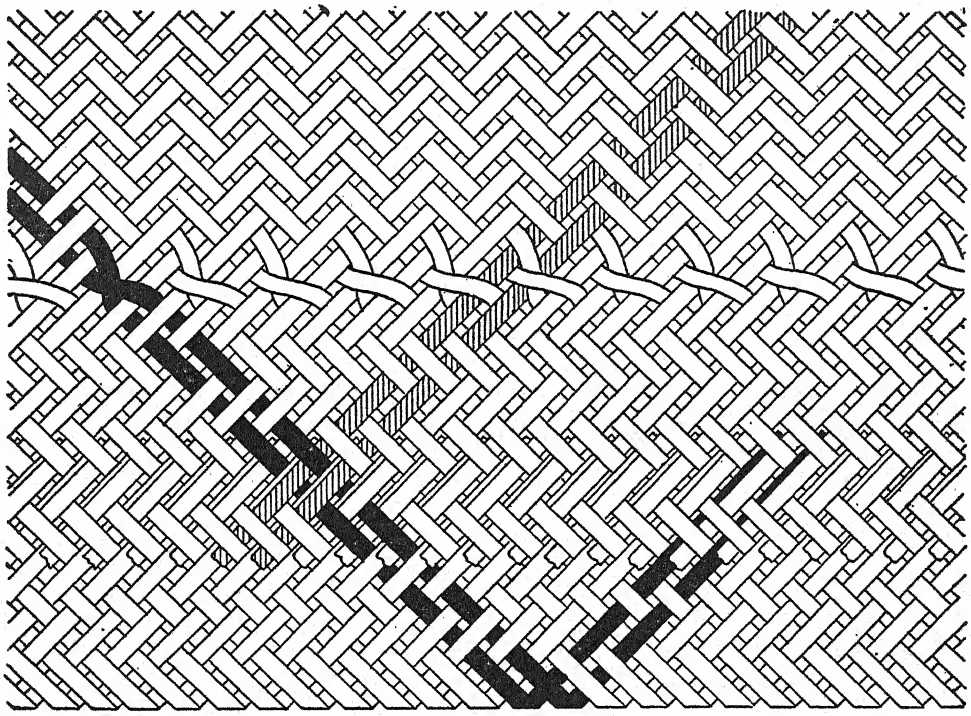


FIG. 37. Border of diagonal twilled tule mat from Cave 9, Table Top Mountain, San Francisco River Canyon.

Oblique Twilled Matting (figs. 37; 38; 107, *b-f;* 108, *a*)

Source and Quantity. Upper Gila area—Cave 1, Goat Basin; Cave 9, Table Top Mountain; Mule Creek Cave; Kelly Cave; Steamboat Cave (1 specimen)—9 fragments.

Materials. Tule (small rushes); bear grass (*Nolina microcarpa*).

Weave. Here we have plaiting with rushes or strips of bear-grass leaves, over-2-under-2 (3 specimens), and over-3-under-3 (5 specimens).

[41] Howard, 1930, pl. XXVIII, 5 and 8; pl. XXXVI, 2.

[42] Coffin, 1932, p. 36. Setzler, 1932, p. 136; fig. 131, p. 138.

[43] Hough, 1914, pl. 16, nos. 2 and 6; p. 89.

One specimen shows over-2 or 3-under-4 or 6, with whole bear-grass leaves 3/16 to 1/2 an inch wide (fig. 108, *a*). The stripped bear-grass leaves are 3/32 to 3/16 of an inch wide, and the tule elements, 1/8 to 3/16 of an inch.

The selvage of mats plaited of bear-grass leaves is formed by bending back each element at the edge, giving it a 90-degree turn, and plaiting it in to continue at a different angle back across the fabric to produce a raised twisted-cord effect on the selvage on the back or non-working surface (fig. 107, *b*). The fragment *c*, showing the front, is a piece of the same mat. In the fragment of the tule mat, *e* (see also fig. 37), woven over-2-under-2, the border is separated from the body by an alignment of the pairs of the elements running in one direction, where they cross and take each other's courses toward the selvage. In the fifth space from the selvage the elements pass over or under 1 instead of following the regular over-2-under-2. The selvage is formed by turning each element back into the border and cutting off the overlapping ends at a uniform distance from the edge. The surplus ends, worked back into the plaiting, cause a thickened selvage at the rounded corners of the mat.

The elements running in the other direction follow their original oblique courses from the body of the mat and do not end where the border starts. This border differs from that of the tule mats found by Kidder and Guernsey in northeastern Arizona in which the elements in the body elements are in vertical twilling, every other one is cut off at the start of the border, and those remaining form the border by being turned at an angle in oblique twilling.[44] The border of the fragment (fig. 107, *e*) is 2 inches wide, and the specimen, 12 inches long.

In the fragment (fig. 107, *f*), the ends of elements approaching each other from opposite directions in the same course are cut off 2 1/2 inches from the selvage, the ends that come out of the upper, or working, face being passed through so that they project in an alignment on the back of the mat (fig. 38, *b*). This manipulation forms an indistinct border, as seen from the working face, and one that is not strongly attached to the body of the mat, since the weave is weakened by elimination at the junction of every other strand. Figure 38, *a*, where some of the elements have been intentionally foreshortened, shows this defect. The border is 2 1/2 inches wide; at right angles to it the specimen is 14 inches long.

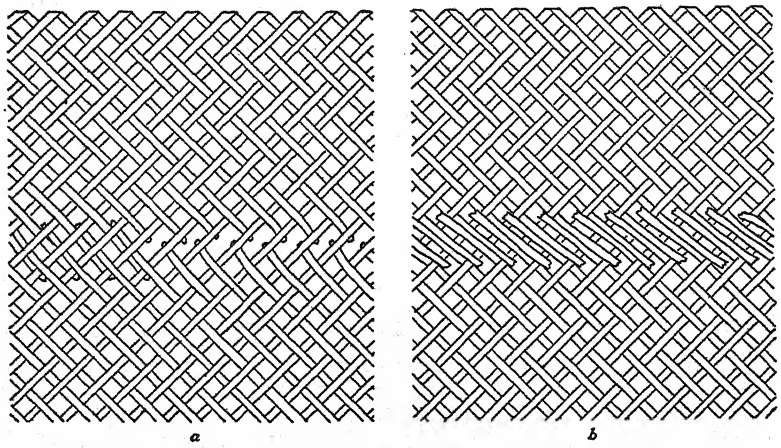


FIG. 38. Border of diagonal twilled tule mat from Mule Creek Cave. *a*, front; *b*, back

Twilled Cradle Lining (figs. 39, 109)

Source and Quantity. Upper Gila area—Mule Creek Cave, 1 specimen.

Material. Strips of bear-grass (*Nolina microcarpa*) leaves.

Weave. Starting at the broad end of the mat, we have oblique twilling, over-3-under-3 in the border and through the body. In the fourth row of twilling from the edge, where the body joins the border, every third strand passes either over

[44] Kidder and Guernsey, 1919, fig. 41, p. 111.

or under 2, 1, or 3 elements, and as they go back into the body of the mat, after forming the 3-row border, they travel either over 1, 3, or 5 elements (fig. 39). A half turn of the flat stiff elements gives a raised-cord effect to the selvage on the back. The weaving terminates at the narrow end of the cradle lining, where it is stiffened by an additional selvage across the back. Here 1 end, 9 inches at the other; 19 inches long over all.

Indicating that this was probably a cradle lining, possibly resting on some sort of frame, is fecal matter still adhering to the wide end on the non-working surface. This side, on which the child was laid, is more or less coated with filth which may have worked through a grass pad

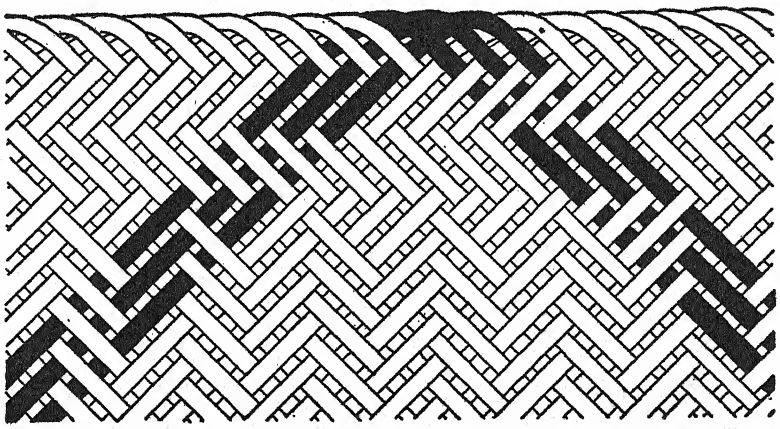


FIG. 39. Side selvage of diagonal twilled bear-grass cradle lining from Mule Creek Cave.

selvage is made entirely from elements protruding on the front face and the other from those on the back, the latter being 2 courses wide and the former 4 courses wide. At the corner where both sets of crossed strands converge, a few of those from the front are turned under and plaited, into the extra selvage, in this way connecting the 2 selvages. Figure 109, *a* makes clear this simple but effective technique. The weaving elements average 3/16 of an inch wide.

Size. The cradle lining is 6 3/4 inches wide at

placed upon it. A greasy spot at the center on the smooth-finished surface, called the front in describing the weave, seems to have been caused by its rubbing on the mother's back as she carried the infant in the cradle. Haury illustrates a cradle with a twilled bear-grass "floor" with an additional loose strengthening back laid in it.[45] It is possible that our specimen was part of a somewhat similar cradle but with only the single thickness of bear-grass fabric laid over the postulated cross bars.

MISCELLANEOUS

Rod Container or Cradle Lining (fig. 108, *c*)

Source and Quantity. Upper Gila area—in refuse of Cave, Site 3, Mogollon-Sapillo section, 1 specimen.

Materials. Partially peeled, slender hardwood twigs; yucca-fiber cordage.

Weave. The twigs are fastened together with twined courses of yucca-fiber cord, spaced 3 1/2 to 4 inches apart.

Size. Nine inches wide, rods varying in length up to 20 inches. This specimen may have been a cradle lining or a container in which articles were rolled for safe keeping.

Flexible Cradle (fig. 110)[46]

Source and Quantity. Upper Gila area—near a series of cists in Steamboat Cave, 1 specimen.

Material. Bear-grass (*Nolina microcarpa*) leaves.

[45] Haury, 1934, pl. XLIII.

[46] At Kelly Cave a local collector found a flexible cradle about 22 to 24 inches long that nearly duplicates the one here described. This site is on the San Francisco, northwest of Steamboat Cave, which is in the southern part of the Upper Gila area.

Weave. The frame and sides are composed of 30 selected bear-grass leaves broken from the plant close to the root; the leaves are laid with their butts at the foot of the cradle and are fastened together by continuous twined strands of shredded and loosely twisted leaves of the same material, woven back and forth; in the process, 3 loops are formed on either selvage by the twining elements. At the head, the tapering ends of the intermediate leaves in the back of the cradle are divided into quarters, each pair joined by a knot, reducing the elements to 2 clusters. This tying gives the cradle back a rounded top. On either side the leaves forming the standing sides of the cradle are divided into 3 clusters, their ends joined by knots. The free ends from each outer side knot are tied to a free end in the opposite cradle-back knot, thus drawing the sides to a vertical position with the strands partially closing the head end. Remains of independent grass strings, looped through the frame, indicate that the head of the cradle was further enclosed by lacing strands. At the foot the broad leaf ends prevent the 2 final closely spaced courses of twining from sliding off the frame. Along the lower end 5 loops are formed by a strand tied to 2 lower side selvage loops and passed around the last twined element with a buttonhole stitch. Pieces of shredded leaf strands, still in place, indicate that these strings were laced through the foot and side loops to hold the infant in the cradle. With the exception of an occasional overhand knot in the lacing elements, all the principal ties are square knots. Finely shredded soft grass had been used to pad the cradle.

Size. The cradle is 18 inches long, 9 1/2 inches wide at the head, and 7 inches wide at the foot; side boards near head, 5 to 6 inches wide.

Although this cradle is manufactured of stiffer material, it is analogous in flexibility, form, twined weaving, and lacing to the Basket-maker cedar-bark cradles found in Caves I and II, Kin-Boko Canyon, in northern Arizona, by Kidder and Guernsey.[47] It duplicates one made of bear grass or split yucca leaves found in a Basket-maker storage cist by Cummings in a western tributary of Segiotsosi Canyon. Cummings refers to this flexible cradle as a basket.[48]

[47] Kidder and Guernsey, 1919, pl. 72; p. 85.

[48] Cummings, 1910, p. 14; illustration, top left, p. 34.

Ring Paho (fig. 111, *f*)

One specimen from Cave 8 in the Hueco area is made from the claw of a *Martynia* pod bent into a 1 1/2-inch circle and bound with a piece of heavy yucca cord. Remains of blue downy feathers held by the cord wrapping seem to indicate that it was a cult object rather than a gaming ring.

Crescent Pahos (fig. 111, *e*, *g*, *h*)

Source and Quantity. Upper Gila area—Steamboat Cave, 5 specimens.

Material. Small twigs with pith center.

Technique. The bark has been scraped from twigs which were bruised at intervals on 1 side with a thin-edged stone so that they could be bent into a crescent and would keep that form. The ends were tapered to a sharp point. There is no indication that the round, sharpened ends were lapped and tied together to form hoops.

Size. One paho is only 2 1/2 inches in diameter; the rest, 5 3/4 to 6 inches; twigs, 1/8 to 3/16 of an inch thick.

Decoration. With the exception of 1 1/2 to 2 inches of the pointed ends, they are colored all over green, yellow, white, or black. A reed cigarette is tied with fiber cord to the crescent shown in figure 111, *e*.

These presumably Pueblo specimens were part of a cache with other offerings, among which were the small gaming sticks, or counters (fig. 148, *a–i*).

Pith Objects (fig. 112, *a–f*)

Source and Quantity. Upper Gila area—Doolittle Cave, Mule Creek Cave; Cave 1, Goat Basin —7 specimens.

Material. Pith, probably from sunflower stalks.

Doolittle Cave produced the only painted objects of this kind; (fig. 112, *b*), a roughly rectangular piece painted red and yellow; and a perforated ball (*c*), 1 inch in diameter, with the central zone made up of vertical bars in black, green, yellow, and red. A perforated ball (*a*), 1 1/4 inches in diameter, from Mule Creek Cave was decorated by burning on its surface delicate interlocked and branching lines overlaid with a zigzag line, producing a serrated effect. Two pith cylinders (*d*), 3/4 of an inch long and 1/2 an inch in diameter, came from Cave 1, Goat Basin. From Mule Creek Cave are the remains of 2 objects (*e* and *f*). One of these has 2 solid, cylindrical bars of pith, 1/2 an inch in diameter, held by a slender wooden skewer, and the other has 3 bars of pith, held together by a piercing skewer, and shows marks of a second pin that held the pieces of pith in series like the slats in the wooden *tablitas*.

At Bear Creek Cave Hough found pieces of painted pith strung or pierced with wooden splints.[1] Morris found painted pith cylinders in caves near Camp Verde, Arizona.[2]

Pith offerings seem to have had a wide distribution, and it is possible that numbers of specimens from the area lying between the Upper Gila and Camp Verde remain unrecorded. As to their significance, little can be said other than to quote Hough: "They appear to be related to the frog-spawn pahos of the Hopi."[3]

Wrapped Fiber Balls (fig. 112, *g–i*)

Three, respectively 1, 1 1/4, and 1 5/8 inches in diameter, from Ceremonial Cave, Hueco Mountains, were made by compressing softened grass and yucca fiber into a ball with tight wrappings and lacings of narrow strips of yucca leaves. The smallest (*h*) has an attached loop made by tying off the ends of the wrapping strands. The Hueco specimens do not contain dried leaves, as do the wrapped yucca-fiber balls Harrington found in a salt mine in Nevada.[4] They were perhaps used in a hand-ball game.

Bone and Wooden Objects (fig. 113)

Specimens *a–d*, *h*, and *j* came from the Hueco area. The fiber-wrapped objects *a–c* are from Ceremonial Cave. Figure 113, *a* is a small animal scapula covered with a pad of fine yucca fiber held in place with strips of the same material. The wrappings on the rodent jaw (*c*) are stripped yucca leaves; that on the tubular bone (*b*) is finely shredded yucca fiber. Figure 113, *d*, from Chavez Cave, is a small animal scapula with the edges smoothed and the bone tinted slightly red. The deer or antelope rib (*h*), with finely notched edges, also stained red, is from the same place.

[1] Hough, 1914, pl. 26, nos. 19–24.

[2] Morris, 1928, p. 93.

[3] Hough, 1914, p. 129.

[4] Harrington, 1926, p. 231.

Figure 113, *e–g*, *i*, and *k* were found in the Upper Gila area. Figure 113, *e* is a deer vertebra, which has sinew threads loosely tied through and about it; figure 113, *f* and *g*, from Steamboat Cave and Cave 1, Middle Fork of the Gila, are bone splinters painted with red oxide. The thick piece of mineralized bone (*i*) from Cliff House 2, S A Canyon, is horizontally drilled from the edges in 4 directions, three of the 5/16-inch holes meeting at a common point and the other missing it but cutting into one of the drilled holes. At right angles to these openings a vertical drill hole in 1 side meets the 3 at their junction. Figure 113, *j*, from Ceremonial Cave, is the point of a *Yucca macrocarpa* leaf and is similar to another specimen, from a cave in the same area, which has narrow strips of yucca leaf sewed through the edges and tied. The piece of bark (*k*), through which yucca is threaded, came from Cave 1, Middle Fork of the Gila.

The use of these objects is problematical. The painted bone splinters suggest some game and the others might be called fetishes. The rodent jaw (fig. 113, *c*) is like one of a pair found by Guernsey with other articles in a pouch accompanying a Basket-maker II burial at Broken Roof Cave in northeastern Arizona.[5]

Rattles (fig. 67, *c–i*)

Source and Quantity. Gourd fragments found in nearly every cave investigated in the Upper Gila and Hueco areas; 1 partially complete gourd rattle, 2 turtle shells, 73 gourd rattle handles.

Materials. Dried gourds and turtle shells; yucca bloom stalks and softwoods (cottonwood, willow, and alder) for handles; pitch to hold handles in place; yucca-fiber cord and sinew for attachment of objects.

Technique. Holes for handles were bored through the gourds at the stem and flowering ends (fig. 67, *f*, *g*, *i*); The holes in the turtle shells (*e*) were bored vertically through the shell. The handles were cut to the desired length and smoothed by scraping or sanding, some slightly tapered (*d*), others with the part of the handle that passed through the gourd reduced in size, leaving a shoulder against which the gourd rests (*c*). Scoring on the handles shows that the gourds were held in place by whippings of cord; pitch was also used for this purpose.

Size. Marks on the handles indicate that the gourds were 3 to 4 1/2 inches thick. The 2 turtle-shell rattles are 1 3/4 and 2 3/4 inches wide. Handles vary from 8 to 10 1/2 inches long, 3/8 to 7/8 of an inch in diameter at the grip.

Decoration. None of the gourds or shells shows the application of paint. One handle has a small touch of green, and it is presumed that the gourd rattles at one time were colored. The grip of 1 handle is scored spirally with a sharp instrument, and channels are scored around the proximal end of handles, one so treated having a sinew wrapping that holds a piece of cord, showing that feathers may have been attached to it. In the proximal end of 5 large handles are sockets, 1/4 of an inch to 1 inch deep, which were gouged or reamed out. No explanation can be given as to this feature.

Several gourd fragments, like figure 67, *h*, have a number of small holes which were not drilled to repair a break by tying, and it is assumed that they were intended either as a decoration or to change the tone of the rattle.

That the rattle was in use during the Pueblo period, and probably earlier, is indicated by pictures on Mimbres pottery showing dancers carrying them, and by the 73 rattle handles found in Doolittle Cave, which was a Pueblo shrine. As mentioned, many caves containing early and late prehistoric specimens in the Upper Gila and Hueco areas produced fragments of gourds.

Reed Whistles (fig. 114, j–*l*)

Source and Quantity. Upper Gila area—Doolittle Cave, 1; Steamboat Cave, 2.

Technique. The reeds were severed with a sharp instrument, as were the reed cigarettes. One specimen has been scored by scraping. A 1/8-inch hole has been cut with a sharp instrument, 1/2 an inch from the end of one and approximately at the middle of another. A 3/16-inch hole has been burned in the large whistle, 1 1/2 inches above the reed joint.

Size. The lengths are 3 5/8, 4 3/4, and 5 inches; diameters, 5/16, 3/8, and 5/8 of an inch.

There is no decoration.

There is some doubt whether the large, jointed reed specimen is a whistle, since the distal end is crimped and charred and the septum is punctured as in the reed cigarettes. However, the other two

[5] Guernsey, 1931, pl. 34, *a*.

are surely whistles, and it is possible to conceive a wind instrument of this kind having been converted into a cigarette for ceremonial use. As far as we know, these are the only whistles of any kind from the Upper Gila; none has been found in the Hueco area.

Reed Cigarettes (figs. 114, 115)

Source and Quantity. Upper Gila area—Doolittle Cave, 48; Lone Mountain Cave, 2; Greenwood Cave, 1; Steamboat Cave, 49; Water Canyon Cave, 3; Cave 1, Middle Fork, 5; Cave 2, West Fork, 1; Mule Creek Cave, 40; Saddle Mountain Cliff Ruin, 12. Hueco area—Ceremonial Cave, 22; Chavez Cave, 7; Cave 4 (Buffalo Cave), 2; Cave 3, Deer Creek, 1.

Materials. Jointed reeds; yucca-fiber and cotton cord; sinew; feathers; tobacco (*Nicotinia attenuata*); herbs; yellow ochre, copper carbonate, and black and white pigments for paints.

Technique. The reeds were sawed with a sharp-edged stone flake and the sections broken off. On a few the squarely cut ends were given an additional smoothing with a fine abrasive stone. Sixty per cent of the cigarettes were severed between joints of the reed, leaving 1/2 an inch of the reed for a mouthpiece and longer barrels of varying lengths above the joint in which the tobacco or aromatic herbs were placed. The septum, which is pierced to make a small vent, prevented the tobacco from being drawn into the smoker's mouth. In some cigarettes short pieces of reed splints were stuffed into 1 end to take the place of the perforated septum (figs. 114, *b*, *c*; 115, *c*); in others, the opening is reduced by a short section of a smaller reed inserted at 1 end. In figure 115, *i*, a slot was cut in the wall of the cigarette and a piece of reed was introduced to take the place of a septum and partially to close the barrel. In some cigarettes without a joint, both ends are plugged with soft fiber between which is the tobacco (*d*, *e*). Figure 115, *d* is split through the center. Either end could be lighted, and the loose plug at the mouthpiece prevented the tobacco from being sucked out.

When finely chopped smoking material was used, the distal end of the cigarette was sometimes plugged with fiber. On several specimens this end was crimped to hold the tobacco in by having the edge turned inward with a thin tool, as in figure 115, *l*; 1 partially burned cigarette (*m*) crimped in this manner shows that a section was first broken out of the side near the crimped end, and the tobacco lighted at this point, as in an elbow pipe. Numbers of cigarettes still hold plugs of partially consumed tobacco, while in others the tobacco, not having been exposed to the light or at all bleached, looks fresh. Strips or chopped particles of the herbs were also used as a filler.

Size. The length varies from 1 3/8 to 5 1/2 inches; a few, 6 1/2 to 9 inches; diameters, 1/4 to 5/8 of an inch.

Decoration. Not many of the cigarettes are painted. Those that are have had the shell of the reed sanded or scraped to break the gloss so that the paint would adhere. However, some of the sanded cigarettes do not show paint, although originally they may have been so treated. Cigarettes are colored all-over yellow, green, white, and black. One is painted lengthwise half-and-half green and black; one has a white side spotted with yellow polka dots, and a yellow painted side spotted with white and black polka dots, and one is all-over green, spotted with black polka dots.

Decoration by Burning: one with 3 sets of 2 parallel burned dotted lines on the barrel above the reed joint; one with a row of burned dots around the end and with a scratched or scored band around the center of the cigarette.

Wrappings of soft cotton, yucca fiber, sinew, and even narrow buckskin thongs at the center or above the reed joint were used alone as a decoration, or to hold beads or colored downy feathers in place. However, 1 cigarette has the feathers stuffed into the barrel instead of bound to the side (fig. 115, *k*). The soft cotton, occasionally dyed red or green, may be loose with streaming ends or wrapped around the reed to form a band as wide as 3/4 of an inch. On 1 specimen the cotton string holds a pink *Spondylus* shell bangle (fig. 114, *h*); another has 3 small black beads and 1 discoidal turquoise bead (*e*); and the sinew wrapping on *d* holds a white discoidal bead.

In the Hueco area wider bands of sinew were used. Sometimes the reed was scored, but only 1 cigarette is painted. The latter has a sinew-wrapped mouthpiece and is striped spirally with 1/8-inch to 1/4-inch dark red lines (fig. 115, *e*). One has the barrel spirally scored (*f*).

Many cigarettes have never been lighted, while others are burned down almost to the perforated septum. There is also some difference in the preparation of cigarettes at the various sites. For example, numbers found at Steamboat Cave were

painted, while none from Mule Creek Cave was so treated. That they were attached to other objects is seen in figure 119, *g*, where one is tied to a large stub paho; another, figure 111, *e*, is fastened to a white crescent-shaped hoop; and 2 others, figure 114, *f*, *g*, are tied to twig pahos. These last are attached to the twigs with sinew held in the ends of the cigarettes by strips of herbs, while sinew bands on both ends at one time held feathers. Other variations are 3 cigarettes filled with reed splints, one with 4 round twigs, and another holding 2 long grass stems and 4 short sections of the same material (fig. 115, *g*). Apparently, these specimens were not intended for actual smoking.

At Bear Creek and Tularosa Caves in the Upper Gila area Hough also found great quantities of ceremonial cigarettes wrapped with colored cotton which held beads and shell ornaments.[6] Among them were sets of cigarettes in pairs, or 3 and 4 bound together. No examples of these combinations are in our collection. The Hough specimens illustrate another variation in a ceremony that may be traced to the Salt River Valley of Arizona, where cigarettes were tied together in this way, but in addition, had a small woven sash wrapped around the bundle. Morris reports reed cigarettes from the Aztec Ruin in northern New Mexico;[7] and Coffin found burned cigarettes with punctured septums at Bee Cave in the Big Bend of Texas.[8] With their appearance in the intermediate Hueco area which includes Deer Creek Cave, a site in the extreme southwestern corner of New Mexico, their distribution north and south in prehistoric times was extensive. Kidder and Guernsey do not mention cigarettes from the Pueblo cliff ruins in northern Arizona, and apparently this form of offering did not enter into the ceremonies of people living in that area. To the west, they have been found near Phoenix, Arizona. Hough states that the Zunis are the only Indians now using such cigarettes. It is therefore possible that in former times their ancestors and other inhabitants of the Little Colorado drainage had the cigarette, which would give it a wider distribution in that direction. At present the Rio Grande Valley seems to mark the eastern boundary.

In listing artifacts, reed cigarettes have been classified as Puebloan, yet their presence in caves of the Upper Gila and Hueco areas, where both Basket-maker and Pueblo cultures are represented, is confusing, especially so when a number came from Ceremonial Cave, a predominantly Basket-maker site. As a symbolic offering they may have been of ancient origin, but from their common occurrence, at times in great profusion in Pueblo ruins, cigarettes seem to belong to a later period.

Feather Ornaments (figs. 40, 116)

Source and Quantity. Upper Gila area, 7. Hueco area, 7.

Technique. Figure 116, *b*, *c*, and *g* are macaw feathers (*Ara macao*). Figure 116, *b* consists of 3 large, yellow, secondary feathers suspended on soft cotton cords attached to the quills by a close seizing of the string, which also holds in place short scarlet breast feathers. The feather (*c*) is purplish-blue with a yellow tip. In figure 116, *g*, the vein on 1 side of the quill is light brown, on the other a golden yellow. Figure 116, *a* is a loosely laid 12-strand cotton cord, spirally wrapped, with narrow pieces of the outer shell of the quill holding the veins of red feathers stripped from the body of the quill. The strips of quill face outward on the cord, probably turned in this way so that the veins would lie flat. Possibly these red feathers are from the Southern Cooper's Tanager (might be any one of several subspecies, the present bird being *rubra Cooperi*). As a foundation for feathers, a piece of cordage (*d*) shows that 2 soft white strings were looped at the center and the 4 strands then wrapped spirally around a stick, after which they were sewed together with yucca thread, as in figure 40, *b* and *c*. The stick was then removed, leaving a cylinder, through the interstices on the side of which the quills of downy white feathers were thrust, filling the center solidly and thus being held in place. Figure 116, *h* is a piece of large feather that has been suspended by a cotton cord held by a whipping of sinew; *i*, a piece of quill decorated spirally with incised lines. Figure 116, *j* illustrates suspension by threading a yucca cord through a hole in the side of a large quill and out through the severed end; sinew wrappings above the knotted cord on the side hold the quills of 2 small feathers. Figure 116, *e* is a strip of buckskin tied to a quill with sinew

[6] Hough, 1914, figs. 222–30, 232–38, 241–45.
[7] Morris, 1919b, p. 57.
[8] Coffin, 1932, p. 32.

wrapping; *f*, a dark feather with a quill at the tip carefully wrapped with a fine thread of sinew between the separated veins.[9] At *k*, feathers were attached to a straight yucca cord by another cord coiled around it in a series of loops, using a buttonhole stitch. In the process each bend between the loops of the stitch was given a turn around the quill of a feather, holding it firmly in place against the straight cord (fig. 40, *a*). suspending feathers were then bound into a tuft forming a tassel. Tassel *m* is provided with tapering tie strings, suggesting that the ornament was fastened around the neck or a limb of the wearer.

Kidder and Guernsey figure tassel feather ornaments, one from Kinboko Canyon and one from White Dog Cave, both Basket-maker sites in the Marsh Pass region of northern Arizona.[10] No

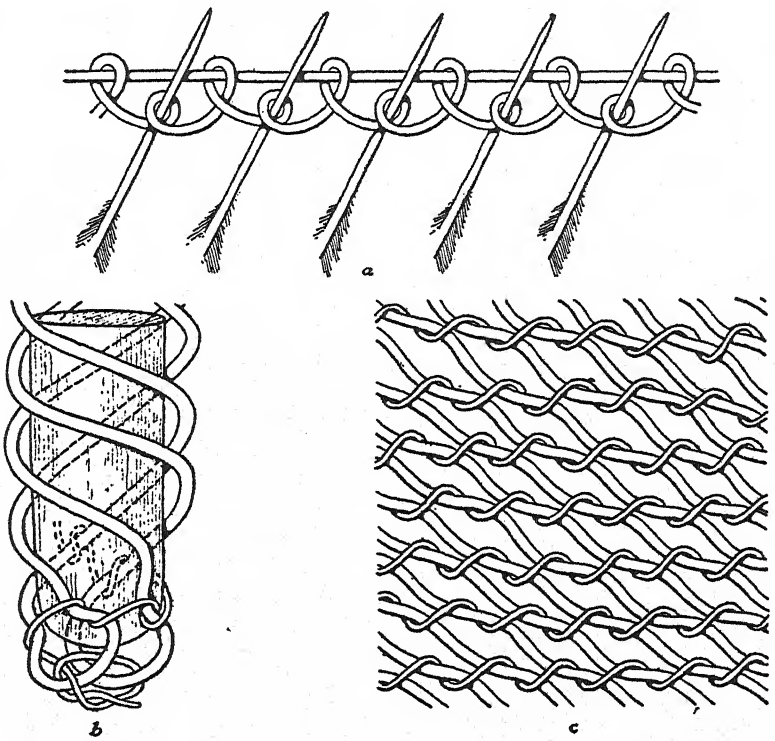


FIG. 40. Feather ornaments. *a*, Ceremonial Cave; *b*, *c*, Mule Creek Cave. *a*, method of attaching pendant feathers to a cord; *b*, *c*, method of making an open-work tubular core for featherstring ornament.

Another specimen (not illustrated) shows feathers suspended in this way and then wrapped around a bundle of 6 2-strand cords. On the looped 2-strand yucca cord at *l*, quills of feathers were bent over the cord and fastened to it by figure-eight whippings of sinew. Figure 116, *m* and *n* are composed of separate yucca strands wrapped around a feather quill, given an overhand knot and the ends twisted together in a 2-ply cord. The cords thus

such specimens were found in the Upper Gila area, but the 2 described above from Ceremonial Cave in the Hueco Mountains are much like those from the north. That the plumage of the macaw as well as the thick-billed parrot was extensively imported from the south is shown by Bradfield's finding at Cameron Creek Ruin in the Mimbres district, 3 macaw skeletons, one with the burial of a woman.[11] Hough secured a bundle

[9] Guernsey and Kidder found a feather wrapped in this manner which was with other other objects in a bundle in a Basket-maker burial, White Dog Cave, northwestern Arizona. Guernsey and Kidder, 1921, pl. 40, *e*. Also Nusbaum in Cave du Pont, southwestern Utah, fig. 7.

[10] Kidder and Guernsey, 1919, fig. 77. Guernsey and Kidder, 1921, pl. 18, *f*.

[11] Bradfield, 1925, p. 176. Bradfield, 1928, p. 159.

of parrot feathers from Tularosa Cave, also in the Upper Gila region.[12] Dr. Kidder informs us that he found a macaw skeleton at Pecos, and we are told that Judd excavated several at Pueblo Bonito. Morris reports macaw feathers from Aztec Ruin.[13] Farther west Hargrave recently unearthed 4 carefully prepared bird burials at Wupatki Ruin, three being macaws and one a thick-billed parrot.[14] Only macaw feathers appear in our collection from the Upper Gila area. They are from Site 6, Water Canyon, which produced nothing but Pueblo artifacts. Whether or not the commerce in such plumage existed in Basket-maker times is as yet unknown.

Grass-stem Pahos (fig. 117, *d–i*)

Source and Quantity. Upper Gila area—Doolittle Cave; Lone Mountain Cave; Greenwood Cave; Steamboat Cave; Mule Creek (well-distributed sites)—great numbers in each. Hueco area—Ceremonial Cave—only 4 specimens.

Materials. Stiff-jointed seed-stalk stems of sacaton (a large grass, *Sporobolus Wrightii*); downy feathers, sinew, cotton, strips of yucca leaves, red and black pigments for decoration.

Technique. The stems were scored with a sharp stone flake at proper lengths and broken off squarely.

Size. Slender stems from 4 1/2 to 16 inches in length.

Decoration. One end is occasionally painted red for a distance of from 1 to 3 inches (fig. 117, *d*). In most cases 1, 2, or 3 small feathers (usually 2) have been attached at the butt end of the quill with a whipping of natural color or red-dyed soft cotton string (*f*) or, more often, with sinew treated in the same way (*i*). Some pahos, without feathers, are decorated with only a loose wrapping and tying of the soft cord (*g*). All specimens from the Huecos are spirally wrapped with narrow strips of yucca leaf that has held the small feathers in place. On several specimens (*e* and *h*) 1 end of the grass stem is painted black and over this, the wrappings holding the quills show that 3 feathers were fastened at both ends with sinew, as on the large arrows. These might be classed as minature arrows, since short sections of grass stems wrapped with sinew to hold 1 or 2 small feathers were found tied to miniature bows (fig. 123). However, the majority of grass-stem prayer-sticks seem to have been set up in caves as offerings in the same way as the wooden stub pahos.

The distribution of the grass-stem pahos appears to be confined principally to the Upper Gila, and, if it extended farther north, it was probably for no great distance. Kidder and Guernsey, as well as other investigators, do not mention such objects from northern Arizona or southern Utah, and with the exception of the few from Ceremonial Cave, none were found in the Huecos, nor have they been reported from the Big Bend in Texas.

Painted Twig Pahos (fig. 117, *a–c*; frontis., *k-m*)

Source and Quantity. Upper Gila area—Doolittle Cave; Lone Mountain Cave; Greenwood Cave; Steamboat Cave; Sapillo Creek Canyon Cliff Ruin; Mule Creek Cave; Cave 1, Goat Basin; Saddle Mountain Cliff Ruin—110 complete and fragmentary specimens.

Materials. Selected, straight, slender switches; sinew; yucca and apocynum cord; red, green, and black pigments.

Technique. The bark was peeled from the switch for painting. The butt ends on the long pahos have been whittled to a point; the top ends sometimes cut off squarely.

Size. The majority are small, from 10 to 15 inches long; a few 30 to 35 inches long.

Decoration. In red, green, and black. Long specimens have red or black butts with the top thirds painted green; one with black butt and bands of black and green above (fig. 117, *b*). The bands vary in width from 1/16 of an inch to 2 1/2 inches. Some slender fragments are painted all-over red or green; others with narrow black bands only, alternate black and red bands, alternate black and green bands, alternate narrow black and green bands separated by wide red bands. One long specimen has, in addition to the painting, 2 whippings, one of sinew holding a piece of fiber cord, and another of soft apocynum string. Although not painted, a few fragments of this type of paho were decorated by removing bands of bark.

Hough discovered numbers of painted twig pahos at Bear Creek Cave in the San Francisco country, some of which were decorated more elaborately than by simple banding.[15] No painted twig pahos were found in the Hueco area.

[12] Hough, 1914, fig. 3.
[13] Morris, 1919b, p. 64.
[14] Hargrave, 1933, p. 26.
[15] Hough, 1914, figs. 339–48.

Unpeeled Twig Pahos (fig. 118).

Source and Quantity. Upper Gila area—Doolittle Cave; Greenwood Cave; Steamboat Cave; Cave 2, West Fork; Cave 1, Middle Fork; Cave 1, Goat Basin; Kelly Cave. Hueco area—Chavez Cave; Cave 6; Cave 8; Ceremonial Cave. Numbers found in both areas.

Materials. Twigs from various brushes and trees; accessory material noted in describing decorations.

Technique. Commonly little work was done on these pahos except to break off small sprouts and leaves. Occasionally the bark has been removed and on some of the longer twigs the butt end whittled to a point.

Size. Judging from fragments, most of the slender twigs must have been from 6 to 12 inches long; a few slightly longer; 2 unusual specimens, 36 and 37 inches in length.

Decoration. The wood or wrappings on this type of paho were never painted or dyed. The decorative substances used were feathers, sinew, with strips of rodent hide or buckskin on one or two (fig. 118, *g*); loose untwisted soft yucca fiber, fine and fairly heavy 2-ply yucca-fiber cord, narrow strips from yucca leaves, loose twisted soft cotton of single strand, 2, 3, 4, 8, 10, and 14-ply cord and on 1 paho (*b*) was tied a 2-strand black human-hair cord. In the Upper Gila most of the twigs are wrapped with 2-ply yucca-fiber cord, while in the Hueco area strips of yucca leaves are more common. The decoration may consist simply of the loose fiber or cotton cord knotted in a bunch at 1 point, or of a 1/2-inch to 3/4-inch seizing of cord. Sinew (*l*) or narrow ribbons of yucca leaves (*j*) are sometimes wrapped spirally around the twig for its entire length. However, the principal object of the seizing was to bind feathers, holding the quill parallel with the stick. Sometimes a single large feather was used (*a*) but commonly 2 or 3 small brightly colored downy feathers were fastened in this way. When more feathers were attached, a fringe with 6 to as many as 16 strands was made by tying short lengths of cord with a full hitch to one of the strands encircling the twig (*c*, *d*, *f*, and *g*). The ends of the fringe were either simply tied around the quill, or, to make the feather hang perfectly and to prevent its coming off, the quill and string above the knot were wrapped with sinew. A knot was not always tied on the fringe strand, and the sinew alone held the feather in place. Above the yucca-cord wrapping on the twig (*e*) is a white bead held in place by a 2-strand piece of cotton, and at *i* (Steamboat Cave) a combination of yucca fiber and a species of *Cuscuta*, possibly *denticulata*, and soft cotton string holds a piece of cornhusk and a short length of sacaton grass stem, as uncertain cigarettes.

A simple variety of paho, several of which were found, is seen in figure 118, *k*, where the twig, while green, was bent into a single loop or coiled twice and the end tied to the stem. Another (*h*) was made by bending 2 twigs at the center and binding them with a wide strip of bark. That other objects aside from feathers were tied to the twig pahos is seen in figure 114, *g* (Ceremonial Cave) and *f* (Steamboat Cave) showing attached reed cigarettes.

In the San Francisco district of the Upper Gila area Hough found quantities of twig pahos in all the shrine caves. Some specimens he illustrates come from Bear Creek Cave on the Blue River, tributary to the San Francisco in eastern Arizona.[16] One of the Bear Creek pahos has an attached cornhusk package, and others have suspended reed cigarettes. Attachment of reed cigarettes to unpeeled twig pahos has thus been noted at widely separated places: Steamboat and Doolittle Caves in the Upper Gila, southeast of Hough's Bear Creek Cave in Arizona, and at Ceremonial Cave still farther south in the Hueco Mountains. There may be a farther distribution of the twig pahos north of the Upper Gila and south of the Huecos in the Big Bend, but as yet there are no data on the subject.

Unpeeled twig pahos occur commonly in sites containing both Basket-maker and Pueblo artifacts, and as they are a very simple and easily made form of offering, it is likely that they had already come into use in the earlier period. Those with cotton wrapping, however, are almost certainly Pueblo.

Stub Pahos (figs. 74, *a*; 119; frontis., *a*, *n*)

Source and Quantity. Upper Gila area—Doolittle Cave, 28 painted, 7 unpainted, 11 unpeeled; Greenwood Cave, 12 painted; Steamboat Cave, 80 painted, 2 unpeeled; Mogollon Creek Cave, 2 painted; Sapillo Creek Canyon Cliff Ruin, 9 painted; Cave 1, Goat Basin, 55 painted, 10 unpeeled; Cave 4, Goat Basin, 3 painted; Cave 5, Sipe Canyon, 2 painted; Mule Creek Cave, 310 painted, 2 unpeeled—total number 533.

Materials. Soft light wood, some of the thick ones ap-

[16] Hough, 1914, figs. 182–91.

parently cottonwood, smaller specimens probably willow, having a pith center; for decoration: sinew, soft cord, small feathers; paints: powdered red (hematite), yellow ocher (limonite), green (copper carbonate), black (soot or vegetal dye), white (probably caliche or kaolinite).

Technique. Parts of limbs were selected to avoid small branches as much as possible, and the pieces were chopped and sawed with a sharp flint implement. One end was cut squarely with the same tool, which usually has left more marks of sawing than of chopping; the opposite end pointed by chopping and afterward shaved as with a sharp flake. Only 1 or 2 specimens show secondary scraping of the roughly whittled point. The bark has generally been stripped from the billet, leaving a smooth surface for painting. Some stub pahos are left with the bark adhering to the stick.

Size. The majority vary from 5 1/2 to 14 1/2 inches in length, average 8 to 10 inches; diameters, 5/16 to 1 1/2 inches; extremely short and stocky specimens, 1 1/4 by 4 3/4 inches (fig. 119, *h*) and 2 1/4 by 10 inches (*i*); unusually long specimens 16 to 26 3/4 inches in length with 1/2- to 1-inch diameters.

Decoration. One hundred and forty-seven are painted all-over red (fig. 119, *e*, *g–i*); 5 spaced half-and-half in 2 tones of red, the darker shade at the top; 9 all-over yellow; 4 all-over green; and 2 all-over white. In specimens with 2-color decoration the upper zone is commonly somewhat narrower than that at the pointed end, though occasionally this may be reversed, or the field equally divided: 3 pahos, red top, yellow below; 1, red top, green below; 1, red top, black below; 8, yellow top, red below (*b*) (a 12 1/4-inch paho with this color scheme out of the ordinary, being mostly yellow with only 3 1/2 inches of lower end painted red); 19, green top, red below; 2, green top, yellow below; 5, black top, red below (*d*); 1, black top, yellow below; 1, black top, white below; 2, white top, red below (*c*).

Five stub pahos, 10 to 15 inches long, are more elaborate, having 3, 4, and 9 bands of diffferent widths in varying arrangements of the colors red, yellow, green, and black (fig. 119, *a*, *f*; frontis., *n*). Among these 5 is 1 (the most elaborate in the collection) with a red end and on the top half 2 bands of green separated by a band of black. The lower green band is striped spirally with black. Another unusual paho is painted in an entirely different manner, having a 5/8-inch red stripe, a 3/4-inch yellow stripe, and a 1/4-inch black stripe, extending from top to point on the natural colored wood (*n*).

Miniature Stub Pahos (see pages 131–32)

Plain and Unpeeled Stub Pahos. Six pahos of regulation size with the bark removed are unpainted, while 27 have the bark left on them, two of which are not pointed at 1 end (fig. 119, *j*). For decoration, both cut ends of 10 are painted red, one has had a single strip of bark sliced from the side, and another has had 2 such longitudinal strips of bark removed (*l*).

Forked Stub Pahos. In the southwestern part of the Upper Gila area were 1 from Greenwood Cave, 4 from Steamboat Cave; in the San Francisco district, 1 from Cave 1, Goat Basin, 1 from Mule Creek Cave. The butt of a forked branch was brought to a point and the top ends squarely cut by chopping and breaking or by sawing (fig. 119, *m*). There is 1 exception, in which the top ends are pointed (*k*). The arms on all but two are the same length. Three are unpeeled, and the rest show bark removed for painting. The lengths vary from 7 3/4 to 15 inches; diameters at butt end, 5/8 to 1 inch. The decoration is as follows: 2 unpeeled forked pahos without paint; large arm on third paho (*k*) painted green, tip of other pointed arm painted the same color; 1 peeled paho painted all-over red; 1 all yellow except point on butt, which is red (*m*); 1, specimen with arms green, lower half red, 1 with varying widths of bands, starting at end of each arm (order of colors: green, yellow, red, yellow, green, the latter reaching just below the fork, and from there on to the end of the point, the butt is painted red).

Additional Ornamentation. Other embellishment for all 3 types of stub pahos consists of downy feathers, the quills of which still remain in the pith holes in the top. String was also attached at this point by being forced into the pith hole. On 1 paho a narrow band of sinew still holds a piece of string, and on a number of others a soft loose twist of cotton string (sometimes dyed red or yellow) is wrapped 1 to 4 times and tied around the body of the paho (fig. 119, *b*, *e*, *j*). Small quills and down in these knots show that downy feathers were included in the decoration. One all-over red paho (*g*), 14 inches long, has a reed cigarette tied to it. The majority of the

pahos do not now retain the string and feathers, and it is possible that some may never have had these attachments.

In describing the painting of pahos, the arrangement of colors has been given in considerable detail, in order to furnish a means of comparison with the prayer-sticks of living Indians, as it is possible that some light may be thrown on the significance, in the case of the ancient examples, of the colors and their position. It would be interesting, for example, to learn the meaning of the large number of pahos with green tops and red ends.

The number of stub pahos is striking, especially since all the sites where they were found had previously been dug into by vandals and it is known that many such specimens had been carried away. The accumulation in the shrine caves in Steamboat, Goat Basin, and Mule Creek Canyons is outstanding. Hough found stub pahos (we do not know how many) at Bear Creek Cave on the Blue River in eastern Arizona. Among these were painted pahos, and others more elaborately wrapped than ours, with strings dyed in 3 different colors. Several have reed cigarettes attached to them, like figure 119, *g*, from Mule Creek. He also found painted forked pahos at the same site.[17] The ancient stub pahos of the Upper Gila resemble those of the modern Pueblo, but the early specimens are thicker and much longer. It is important to note that the stub paho is almost certainly a Pueblo rather than a Basket-maker trait. Not a single specimen was found in the predominantely Basket-maker Hueco area, and so far as can be ascertained, none has appeared in the Big Bend caves or in Coahuila.

Crook-staff Pahos (fig. 120, *p–u*)

Source and Quantity. Upper Gila area—Doolittle Cave, 2 crooked ends, 9 curved fragments; Steamboat Cave, 1 nearly perfect paho and head of another; Cave 1, Goat Basin, 1 crooked head; Mule Creek Cave, upper portion of a decorated staff with a perfect head.

Materials. Small straight branches of light wood; sinew, pitch, red and green pigments, for decoration.

Technique. The branches have been peeled, twig knots smoothed off, and the bodies scraped and sanded. The end of 1 branch (fig. 120, *q*) was reduced by half to allow bending. The end of stick (*u*) required more thinning in order to bend the remaining portion, and the staff below the head was cut down from 7/8 of an inch to 1/2 an inch in diameter. Another (*r*), oval in cross section, was thinned and tapered at the end for bending. At the fork on *t*, 1 branch has been cut away and the other bent into a crook.

Size. Figure 120, *u* is 23 inches long and 1/2 an inch in diameter; specimen *t*, 20 inches long and 1/4 of an inch in diameter; fragments of other crooks, 5/16 to 3/8 of an inch in diameter.

Decoration. Only 2 pahos (fig. 120, *t*, *u*) are decorated; on the lower part of *u*, 4 3/8 inches below the head, is a design in diamonds with serrated edges burned into the wood for the full length of the staff; on *t*, the upper 7 1/2 inches is painted green, the lower part, red.

The top of only 1 specimen (fig. 120, *u*) has the thinned portion bent into a semicircle and the end tied down with sinew passing around it and through a hole in the head (drilled hole afterward filled with pitch). The butt end of *t* is pointed, showing that it must have been set upright in the ground.

In the San Francisco country (Upper Gila) Hough found several crook pahos in Bear Creek and Johnson Caves, one of which almost duplicates figure 120, *u*, with the closed head, the rest having the open hook, or real crook, as *r* and *t*. He also shows a specimen from a cave near Silver City, New Mexico, with the head bent into a circle but not tied down.[18] One of the Hough specimens was decorated with incised zigzag lines, and another painted red and black. Kidder and Guernsey obtained the crook staffs in Cliff ruins of northern Arizona,[19] and they seem to prevail throughout that area, as is seen by the numbers found at Pueblo Bonito by Pepper.[20] There is no record of crook-staff pahos having been found in the Big Bend region.

As was the case with the roundel-staff pahos, the decoration of Mimbres pottery from the Swarts Ruin shows the crook-staff paho in a number of different roles in religious observances.[21] Since this site and Doolittle Cave, where such pahos also occur are definitely Pueblo, our finds confirm the opinion of Kidder and Guernsey that they belong to that period.

[17] Hough, 1914, pl. 18; pp. 92–93; fig. 200, p. 96.
[18] Hough, 1914, pl. 19; figs. 198, 199.
[19] Kidder and Guernsey, 1919, pl. 47
[20] Pepper, 1920, figs. 55–57.
[21] Cosgrove, 1932, pls. 225, *c*; 228, *d*; 229, *b*, *c*.

Roundel-staff Pahos (fig. 120, *a–o*)

Source and Quantity. All Upper Gila area—Doolittle Cave, 1; Greenwood Cave, 3; Steamboat Cave, 4; Mule Creek Cave, 10.

Materials. One of yucca bloom stalk, the rest of light wood with pith center; paints: red oxide of iron, yellow ochre, copper carbonate, and black pigment (undetermined material); sinew, cotton cord, feathers, beads.

Technique. These straight, tapering branches with the bark removed, have been scraped and smoothly sanded. The cutting was done with a sharp-edged flake and abrasive stones.

Size. One complete specimen is 42 inches long; diameters of shafts, 5/16 to 5/8 of an inch; the butt ends of some branches are shown by carved knobs to have been 3/4 of an inch to 1 1/8 inches in diameter.

Decoration. Principally by carving, which usually is in the form of a 2 1/2-inch to 4 3/4-inch grip or handle at the large or upper end, so well executed as to have the appearance of lathe work. The heads vary in shape. Those that are flattened have round, oval, semicircular, or crescent-shaped openings through them, while in others, the same effect is produced by deep carving on either side of the head. The grip may taper to a slight shoulder at the lower end, or terminate in a plain raised ferrule, sometimes encircled with incised parallel lines (fig. 120, *g*). Often the ferrule has a V-shaped channel, giving it the appearance of a spool or a pulley slid onto the shaft (*m*). Another instance of incising is seen at *b*, where the handle between the knob and spool has 2 sets of 4 parallel lines scored around it. Figure 120, *j*, the upper end of a paho, seems to be part of a staff that was carved for a considerable distance into a series of tapered sections much like the joints of a reed. Most, if not all, pahos were painted; some, all-over in red, green, or yellow; one, all-over red except the knob and spool which are green; one specimen with the upper third green, the rest of staff red; another with grip red; another with grip red, 4 inches below which starts a series of 1/8-inch black, longitudinal, zigzag lines extending to the end of the fragment; still other fragments with alternate sections somewhat resembling jointed reeds, painted black and green or green and red. Wrappings of sinew, and some cords holding feathers and beads, show other decorations on the staff pahos, many of which probably have come off, since beads on short lengths of cord were found in the cave refuse. The handle of *f* is wrapped with a 3/16-inch band of sinew, and the grip of *o* is loosely wrapped with cotton cord, still retaining 2 black stone beads. Below the grip of *k*, the staff is wrapped for a distance of 2 1/2 inches with heavy cotton cord, while in the same position on *g*, soft cord wrappings still hold the remains of downy red black feathers.

All specimens were found in the southwestern part of the Upper Gila area, over half coming from the San Francisco district. Hough describes roundel pahos from Bear Creek Cave in the San Francisco drainage of eastern Arizona. One of his complete specimens measures 36 inches long; some were painted red, green, and black and had cotton and yucca cord tied around the handles.[22] In southwestern Colorado Morris discovered similar objects in Johnson Canyon,[23] as did Nordenskiöld and Fewkes at Mesa Verde.[24] Many were found at Pueblo Bonito by Pepper.[25] Fewkes also illustrates roundel pahos from graves at Awatovi and Sikyatki in the Hopi country. The treatment of the heads on these mortuary offerings, however, was somewhat different from that used on those from the Upper Gila.[26] Thus the roundel paho has a distribution from the Upper Gila to Colorado, but to the south we found none in the Hueco area, nor have they been reported from the Big Bend area of western Texas. Examples with button heads and grooved pulley-like ferrules are depicted on Mimbres pottery with great accuracy. The drawings also indicate feather attachments, and in 1 instance a paho is held in the hand of a priest who appears to be chanting a song.[27] Evidently this type of shrine cave offering is a Pueblo trait, since none has been found definitely associated with Basket-maker remains.

Dart and Stalk Pahos (fig. 121)

Source and Quantity. Hueco area—Ceremonial Cave, 24 broken dart pahos, and 78 fragmentary stalk pahos.

Materials. All dark pahos except figure 121, *i* (of hardwood) are of sotol bloom stalks; stalk pahos of same material unsmoothed, 1 exception being a rough, unpeeled

[22] Hough, 1914, pl. 20; fig. 201.
[23] Morris, 1919a, pl. 44, *f*.
[24] Nordenskiöld, 1893, pl. XLII, 2–8, p. 100. Fewkes, 1916, fig. 11.
[25] Pepper, 1920, figs. 53, 54.
[26] Fewkes, 1898, pls. CLXXIV, CLXXV.
[27] Cosgrove, 1932, pl. 228, *a–d*.

hardwood branch; split yucca leaves, loose yucca fiber, yucca-fiber cord, and sinew used for decoration.

Technique. Only dart pahos are smoothed, the others being the rough stalks broken from the sotol plant with the leaves stripped from the stem. The cords and fiber strands are tied with a square knot, occasionally a single loose end being attached to the stick with an overhand knot.

Size. The dart pahos, without foreshafts, measure 53 to 67 inches long (lengths established by complete darts in this and other collections from the site, page 51); stalk pahos, 63–70 inches long.

Decoration. The body of the dart or stalk may be wrapped spirally for varying distances up to 15 inches with loose fiber or narrow strips of yucca leaves (figure 121, *a* and top of *c*). Large knots of fiber are tied along the stick, *b*, sometimes combined with a series of narrow bands of yucca-leaf ribbons. Some specimens show fragments of 2-strand yucca cord held by these wrappings (*e*). Only 1 specimen in the lot has remains of feathers held to the stick with strips of yucca leaves. One dart fragment has a piece of fiber cord fastened to it with wrappings of sinew (only instance where sinew was used in this way); another piece of dart wrapped with 2-ply fine yucca cord, dyed red and yellow (*c*). In conjunction with numbers of the above decorative combinations, the most striking feature is the use of 1, 2, or 3 obovate fiber bundles fastened to the proximal end of dart pahos or to the tip end of stalk pahos (*b*, *d*, *g*, and *i*). The bundles are of loose fiber wrapped and attached as by a stem to the stick with strands of the same material. Inside each is a quantity of finely chopped Indian tobacco. The bundles are 1 1/2 to 4 inches long, 1 to 1 3/4 inches in greatest diameter. One fragment of stalk paho (*h*) has a set of 3 slender-pointed hair ornaments of hardwood tied to it with untwisted fiber. Other specimens with attached hair ornaments came from this site. A few are in the collection of Mrs. D. B. Smith, of El Paso, and Roberts illustrates darts trimmed in the same way.[28] In the Smith collection are 2 darts and 11 stalk pahos, one of the latter having a cluster of fiber cords held at the tip of the stalk by wrappings of the same material. At the end of each free strand in the tassel is a sinew whipping that originally held a feather. Thrust through other soft fiber wrappings on the stalk are 2 single needle-like hair ornaments and a 2-prong hair ornament held together with fiber cord. Another has 2 fiber bundles at the top, and below these are fastened 3 single hair ornaments. A third in the collection has a 4-inch by 5-inch soft fiber mat tied to it like a small pennant. On the plate referred to, Roberts illustrates 7 dart pahos, 4 of them full-length dart shafts with foreshafts missing. Another lot consisting of 3 complete darts and 9 stalk pahos of this type, some with 1 and 2 tobacco-filled bundles, came from the same cave and is now in the possession of R. B. Alves, of El Paso.

This form of offering seems to be strongly localized, since all, so far as we know, came from Ceremonial Cave. The foregoing list by no means gives the exact number of dart and stalk pahos that were left in the cave, for quantities of them had been trampled and broken to pieces by previous visitors to the place. That some of the stalk pahos originally had been set upright in the dirt was shown by 6 or 8 inches of their large ends being discolored. None of the dart pahos were marked in this way and probably were supported in some other manner.

Aside from those attached to the dart and stalk pahos, numbers of hair ornaments were found in Ceremonial Cave refuse and in other caves in the vicinity. Since the hair ornaments and darts duplicate specimens found in Basket-maker sites in northern Arizona, it is reasonable to assume that those here recorded were placed in the shrine by Basket-makers.

Arrow Pahos (fig. 122)

Source and Quantity. Upper Gila area—Doolittle Cave, 3 specimens; Steamboat Cave, 3 specimens; Cave 1, Goat Basin, 2 specimens; Mule Creek Cave, 22 specimens. Hueco area—Cave 9, 1 specimen.

Material. All fragments of plain and painted reed arrows.

Decoration. These are decorated with loose knots of cotton or a whipping of cotton or fiber cord. The cotton cord, often dyed red, green, or black, is usually a soft twist, but single fine threads, occasionally as many as 8, make up a thick cord. The fiber cord is 2-ply and not large. Wrappings are found, used alone or to bind downy feathers to the shaft. One fragment of foreshaft (fig. 122,

[28] Roberts, 1929, pl. 3, fig. 7.

a) is wrapped with cotton cord on which are strung 14 small black beads. Usually these decorations are fastened near the nock end of the arrow, which presumably was stuck point-down into the earth.

Hough illustrates broken reed pahos from Bear Creek Cave, some of which may well be parts of arrow pahos.[29] With the exception of 1 string-wrapped paho found in the Huecos, in a Pueblo shelter, all such objects emanate from shrines in the Upper Gila area.

Some of the arrows with imitation heads of wood (p. 63), which also came from these shrine caves, could well be classified as arrow pahos, even though they are without the cord wrappings.

Miniature Grooved and Incised Fending Sticks (fig. 72, *e–g*)

From Ceremonial Cave came 3 complete and 1 fragmentary miniature stick (for description of full-sized sticks, see pp. 58–60). All are of oak, as are the large specimens, and are as well finished.

The proximal end of a stick (fig. 72, *f*) is nearly square; distal end rounded; sides slightly rounded; edges flat. Its length is 14 1/2 inches; width, proximal end, 7/16 of an inch increasing to 5/8 of an inch at distal end; thickness, 1/4 of an inch; curvature, 3/4 of an inch, perpendicular to chord at mid-point. Excepting 3/4 of an inch of the proximal end, both sides are completely covered with carving, apparently done with a stone flake which acted as a gouge chisel. One side is entirely covered with longitudinal parallel zigzag lines; and on the other side, 2 zigzag lines extend through the center from the 3/4-inch hand-hold to the end. For a distance of 6 inches from the proximal end, short gouge marks extend downward to the edge of the stick on either side of the center lines. Beyond this, the parallel zigzag lines cover the side for a distance of 3 inches. From this point to the distal end the original design is continued, but with the direction of the side gouge marks reversed.

The stick (fig. 72, *g*) is S-shaped; proximal end slightly pointed and scored transversely on the sides for 1 1/4 inches; edges of distal end are cut away, reducing it to 3/16 of an inch in width; sides slightly rounded; edges flattened. The length is 16 inches; tapering from 7/16 of an inch to 1/2 an inch in width at the wide part of the distal end; thickness, 1/4 of an inch. Three parallel lines are incised for a distance of 7 inches on 1 side only; no other decoration.

The stick (fig. 72, *e*) has a smoothed 3-inch hand-hold on its proximal end; both ends rounded; sides slightly rounded; edges flat. Its length is 20 1/4 inches; width, proximal end, 9/16 of an inch increasing to 5/8 of an inch at distal end; thickness, 5/16 inch; curvature, 1 3/4 inches, perpendicular to chord at mid-point. The decoration consists of 3 incised lines on either side, broken into sections of irregular length by the presence of knots in the wood.

The miniature fending sticks must necessarily be classed either as toys, or, more likely, as cult objects. We have heard of no similar specimens from other districts and can only say that since they came from Ceremonial Cave in the Hueco Mountains, where the large grooved fending sticks and the darts decorated as pahos were found, they must be prayer-offerings of the Basket-maker period.

Miniature Ceremonial Bows (fig. 123, *f–i*)

Source and Quantity. All Upper Gila area—Doolittle Cave, 10; Lone Mountain Cave, 3; Greenwood Cave, 10; Steamboat Cave, 16 perfect and 196 fragments; Sapillo Creek Canyon Cliff Ruin, 8; Cave 1, Middle Fork, 2 specimens; Cave 2, West Fork, 1 specimen; Mule Creek Cave, 63 perfect and 111 fragments; Cave 1, Goat Basin, 13 perfect and 61 fragments; Saddle Mountain Cliff Ruin, 5.

Materials. Light wood with pith center; yucca fiber and soft cotton string; red and yellow ochre, copper carbonate, and black pigments used for decoration.

Technique. The bark was removed from small branches and twigs; and additional work was done by whittling and scraping with a sharp stone flake. Marks and bruises on the limbs of some of the larger bows show that they were pounded and kinked, and thus bent into shape. Most of the bows have no string notches, while some have 1 or 2 notches, or a groove encircling the end.

Bow Strings and Attachment. Bow strings are loosely twisted 2-ply yucca fiber, some very fine. Occasionally the string was made of 2-ply or 3-ply cotton. The string is attached by an insecure knot or a half hitch with the free end wrapped several times around the bow tip.

[29] Hough, 1914, figs. 189, 190–95.

Size and Shape. The lengths vary from 7 3/4 to 25 3/4 inches; diameters at center, 3/16 to 7/16 of an inch. Most bows round throughout their entire lengths. The larger specimens have limbs flattened on one or the other side. Some are oval in cross section, others with oval back and flat belly. In these offerings there is a greater variety of shapes than in the large hunting bows.

Decoration. All bows are painted, most all-over red, some all-over yellow, green, or black. Others have a red back and yellow belly, yellow back and green belly, or the reverse of the last 2 colors. There is a great variety of color combinations. Bows may be painted half-and-half in 2 colors; or starting from a plain or painted center, the limbs may be another color or banded in all 4 colors, red, yellow, green, and black (fig. 123, *f*). Bands are usually wide, although on 1 or 2 specimens they are 1/2 to 3/4 of an inch in width. Additional decorations consist of loose cotton cord tied to the bow or bowstring (*f*, *g*). Small quills show that downy feathers have been held by the knots in these wrappings. None of the bows of this collection has an attachment of reed cigarettes or cornhusks, although these appurtenances may have been present originally and subsequently destroyed by rodents. Hough reports painted ceremonial bows with these embellishments from the Upper Gila at Bear Creek Cave.[30]

The number found, especially at Steamboat and Mule Creek Caves, is remarkable, since these caves as well as others in the district had previously been dug over and it is known that many ceremonial bows have been carried away.

The bow cult, involving the use of small as well as large hunting bows, has existed among the Pueblo from prehistoric to modern times. Evidence of their ceremonial use has been gathered from the Upper Gila well into the Hopi country; also from ruins farther east in Chaco Canyon. Pepper mentions numbers of slender curved ceremonial sticks from the rooms at Pueblo Bonito and shows pairs of such objects attached to roundel-staff pahos.[31] From his description and the illustration they seem to be regulation miniature ceremonial bows. Their distribution, however, ends with the southern boundary of the Upper Gila, and so far as we know, they have not been found in the Hueco or Big Bend areas.

[30] Hough, 1914, figs. 206, 207.

Miniature Ceremonial Bow Sets (fig. 123, *a–e*)

A variation of the foregoing, in which cult objects are attached to standard miniature bows.

Source and Quantity. All Upper Gila area—Steamboat Cave, 5 sets; Mule Creek Cave, 28 sets.

Steamboat Cave Specimens (fig. 123, *a–c*). Every set is made up of 1 bow, 1 pointed colored wooden stub paho, and 5 grass-stem pahos. The bows are 6 3/4 to 7 5/8 inches long; diameter, 3/16 of an inch; all are painted red. The stub pahos are 3 5/8 to 3 3/4 inches long; diameter, 3/16 of an inch. Three are painted all-over red; 1 striped longitudinally red, yellow, and black; 1 striped longitudinally red and yellow, leaving a stripe uncolored. There is a small hole for a feather in the squared end of each paho. The grass-stem pahos are 4 1/2 to 6 inches long. They are wrapped with narrow sinew bands to hold small feathers. The bows and pahos are tied together at the center with loosely twisted cotton cord.

Mule Creek Cave Specimens (fig. 123, *d*, *e*). The majority of these sets consist of 1 bow and from 1 to 5 grass-stem pahos. In 3 sets a fragment of a large reed arrow was included with the grass stems. These are of a size to suggest the use of a standard arrow in the assortment. Another departure is the presence of 2 bows in some sets (*e*). The bows are 7 1/2 to 16 inches long; diameters, 3/16 to 3/8 of an inch (majority, over 9 inches in length). Most of the bows are painted all-over red. Some, as in the other ceremonial bows, are painted in combinations of colors, such as red, red or yellow limbs, red back with green belly, red back only, longitudinal stripes of red and black. The grass-stem pahos are 5 1/2 to 12 inches long. They are wrapped with fiber, soft cotton cord, or bands of sinew that held small feathers. The sinew bands are sometimes dyed red. The bow and pahos are tied together with soft cotton cord, which in some instances is dyed red.

From the above tabulation it can be seen that the difference in length of bows and pahos from the 2 sites is marked, and that the larger bows from Mule Creek Cave are most elaborately decorated. Also, it may be noted that there are no small stub pahos in the sets from Mule Creek

[31] Pepper, 1920, fig. 53; p. 145.

Cave, which seems to show a variation in Ceremonial practice even though the large stub pahos (described on p. 126) were gathered at both places. The grass-stem pahos, tied to bows, could well be considered miniature arrows, and it is possible that the great number found in caves of the area, though not fastened to bows and not having foreshafts in 1 end, could also represent arrows. At Bear Creek Cave Hough found ceremonial bow sets that did not include the wooden stub paho.[32] Arrows in these sets had wooden foreshafts, which was not the case with the specimens from Mule Creek and Steamboat Caves.

Split-stick Wands (figs. 41; 124; frontis., *i*, *j*)

Source and Quantity. Upper Gila area—Cave 3 in the Mogollon-Sapillo section; Steamboat Cave; Mule Creek Cave. Hueco area—Cave 8; Ceremonial Cave—12 specimens.

Materials. Yucca bloom stalk; red, yellow, green, blue, white, and black paints; specularite; sinew and cotton cord.

Technique. Lath-like strips were split from straight-grained stalks, and the sides and edges sometimes smoothed by scraping or sanding. The ends are squared. Slots and round holes have been cut in the lath, and fine, deep, or wide notches cut on the edges with a sharp instrument.

Size and Shape. The length varies from 8 1/2 to 27 inches; width, 3/4 of an inch to 1 3/4 inches; thickness, 1/32 to 5/16 of an inch. The majority are flat; one slightly ovoid; another hemispherical in cross section, having a tang or handle on the end.

Decoration. Notched edges (fig. 124, *c*, *g*); holes bored or cut in the laths (fig. 124, *a*, *e*, *g*; frontis., *i*, *j*); zigzag lines burned with embers (*f*); painting in solid color (*h*), and in bars, yellow, black, green, and yellow (*b*); waved black line (*a*); waved green line (fig. 124, *c*); bands along edges and ends, left edge black, right, red (*d*), semicircular bands (*e*); and small queer figures done in exceptionally fine-line work (fig. 41); order of colors starting from the top, black, green, black, green, black, red (*i*).

Although in certain respects the split-stick wands resemble the miniature painted wooden *tablitas*, these objects seem to have been carried in the hand rather than to have been parts of headdresses, as the *tablitas* are thought to have been. This usage is suggested by the tapered end of *a*, the handle on *h*, and the evidence of a grip which has been attached with sinew to 1 end of *e*. Above a long slot in the latter there are 3 concentric semicircular bands in yellow, black, and blue, with black dashes radiating from the top suggesting rays. The top edge is green. This wand is somewhat similar in decoration and form to the narrow board with handle at 1 end carried by the Hopi women in the Manzrauti ceremony during the October festival.

The wand (fig. 124, *g*) with the deep slots in the edge is unusual, and when in perfect condition must have been very attractive. It is painted yellow and light green with a purplish waved line glistening with specularite. The banded wand (*i*) is the only one with a whipping of sinew that holds the remains of a cotton thread to which a feather may have been tied. The specimens in figure 41 are scarcely more than a shaving in thickness, and the small figures painted on them show unusually fine-line brushwork.

Hough shows 2 painted-stick wands, or "pahos" as he calls them, which came from Bear Creek Cave.[33] Distribution of the wands in the Upper Gila and Hueco areas is the same as that of the *tablitas*, and as stated in regard to the *tablitas* (pp. 134–35) these split-stick wands may have been a product of both the Basket-maker and Pueblo cultures.

Wooden *Tablitas* (figs. 125; 126; frontis., *b–h*)

Source and Quantity. Upper Gila area—Doolittle Cave; Lone Mountain Cave; Greenwood Cave; Steamboat Cave; Cave 3, Gila; Water Canyon Cave; Cave 2, Middle Fork; Mule Creek Cave; Saddle Mountain Cliff Ruin. Hueco area—Ceremonial Cave; Cave 5; Cave 7; Cave 8; Cave 9—large numbers of thin laths from broken *tablitas;* 1 perfect specimen; 6 fragmentary specimens sufficiently complete to suggest how the finished *tablita* may have appeared.

Materials. Dry bloom stalks of the *Yucca elata* (1 exception in which a thin plate of juniper wood was used as a base for the *tablita* (fig. 126, *c;* frontis., *b*); sewing element, yucca fiber and sinew; pigments: hematite for red, yellow ochre copper carbonates, melachite, and azurite (last 3 furnishing shades of green and blue), possible soot or vegetable dye for black, probably kaolinite for white; occasionally melted reddish pitch or the soluble mesquite gum as cement or for decoration.

Technique. The bloom stalk of the yucca is soft, very light, stiff, and straight grained, easily split into thin flat laths. The laths were scored and

[32] Hough, 1914, fig. 205.

[33] Hough, 1914, fig. 217; pl. 22, no. 11.

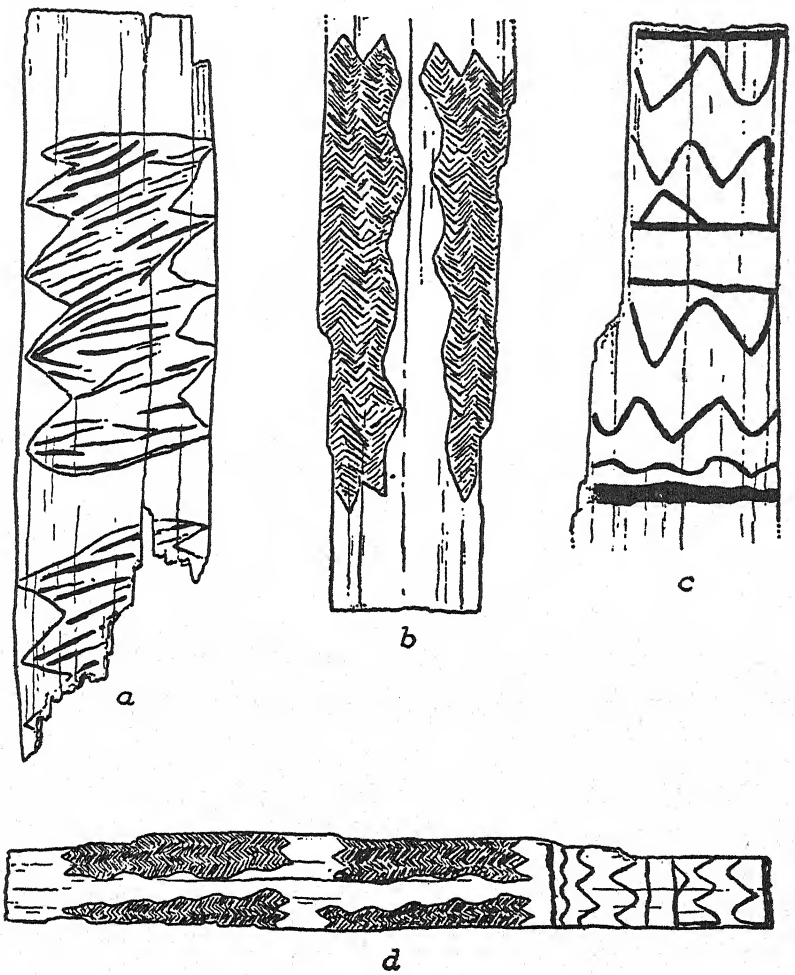


FIG. 41. Split-stick wands. *a–d*, Ceremonial Cave.

broken into desired lengths and sanded into various forms. The sides were left unsanded, but edges were rubbed on an abrasive stone and smoothed. They were then punctured with a sharp awl and sewed together with either a tight-twist or loose-twist 2-ply fiber cord, some being very fine. Laths fastened in this way to cleats on the back were at times held more firmly with pitch. In 1 specimen (fig. 125, *k*) frontis., *h*), the laths are laid diagonally on top of each other, sewed and cemented together with pitch, making a stiff 2-ply board. Laths were cut into varying lengths and sewed together to form tapering or terraced objects; some were cut into forms suggesting flower petals, feathers, or the complete wing of a bird (wings are shown in figure 126, *a* and *e*).

Size. The laths are from 1 to 11 inches long; width, 3/4 of an inch to 1 3/4 inches; thickness, 1/16 to 1/8 of an inch. There are no means of determining the original size of *tablitas* except in the case of figure 126, *c*, which is 7 inches long and 6 3/4 inches wide. Other broken specimens measure 4 1/8 to 9 3/4 inches in length by 4 1/4 to 6 7/8 inches in width.

Decoration. The decorative effect gained by shaping the laths was enhanced by the use of the above listed paints, often in various pleasing combinations. Some were covered entirely with 1 color, others with bands of different widths, so arranged that when the slats were fastened side by side a terraced figure was produced. The painted designs consist of broad waved lines, broad and narrow zigzag lines (this arrangement

in black, red, and white is seen in figure 126, *c* (frontis., *b*), large dots and circles, serrate edging, lines or rows of acute triangles. One specimen (fig. 126, *o*) bears a face with diamond-shaped eyes, triangular nose, and square mouth. One fragment (fig. 125, *g*) shows a flexed arm in red with the hand painted green. Brushwork is usually heavy, yet on some specimens, in spite of the spongyness of the wood, the lines are even and narrow.

The colors represented on the specimens in figure 125 are listed from the top: black on green (*a*); black on plain wood (*b–d*); black on white (*e*, *n*); black circle and dot, yellow between (*f*); alternate red and black (*h*, *k*; frontis., *g*, *h*); dots outlined black (*i*); green dots, black background (*j*; frontis., *d*); banded in various arrangements of plain, yellow, black, green (*l*, *m*, *o*; frontis., *m*).

The colors represented on the specimens in figure 126 are as follows: On the bird wing (*a*), divided by a white bar, the outer end is black with a semicircle of green on 1 edge outlining black petals, and on the lower end a white zigzag figure on green background. Specimen *b* is green on the end and along 1 edge; feathers or petals on *c* (frontis., *b*) tipped green, body alternate black, red, and white zigzag lines; *d*, green tips; bird wing, *e*, all-over green. For *f*, see below; *g*, upper solid green, ends of lower 2 slats, black; *h*, green tip with wide and narrow bars; *i*, both ends green; *j* (frontis., *c*), green tip, base black and green bars; *k*, pitch between laminations, no color remaining. Specimen *l* shows traces of green; *m*, background and bull's eye reddish pitch, unpainted circle outlined with red paint; *n*, decoration in red; *o*, features in black. Where color on specimen is not mentioned the wood has been left plain.

Hough illustrates a number of *tablita* fragments from Bear Creek Cave in the Blue River in eastern Arizona.[34] In the same report he shows "plumes on bird pahos" (figs. 218–20) from Greenwood Cave, near Silver City, a site at which we also found fragments of such objects. Roberts shows a *tablita* from the Huecos much like figure 126, *n*, which also came from that area.[35]

The name *tablita* has been rather arbitrarily restricted to objects made from thin strips of wood assembled to make miniature or full-sized headdresses, similar to those of the present-day Pueblo. The bird or flower symbols may have been either attached to headdresses or used independently as shrine offerings.

The fragment of the *tablita* (fig. 126, *k*) was so cut as to allow it to fit over the head. The others, including figure 126, *c*, the only complete prehistoric specimen of this kind ever seen by the writers, have no drill holes or marks to show how, or if, they were intended to be attached to the dancer's head.

Tablitas seem to have been restricted to the Upper Gila and Hueco areas. In workmanship and decoration, those from the Huecos are crude in comparison with the much greater number found in the Upper Gila. Since quantities have been found in Pueblo caves, their principal use appears to have been by that people. However, some of the Upper Gila sites in which they were found also produced evidence of Basket-maker occupancy, and as the remains in the Hueco caves were predominantly early, there is indication that *tablitas* may also have been a Basket-maker product.

Wooden Bird (fig. 126, *f*)

Source and Quantity. Upper Gila area—Doolittle Cave, 1 specimen.

Material. Softwood of the yucca bloom stalk.

Technique. The specimen was scraped and rubbed into shape with an abrasive. There is a hole bored diagonally through the head, emerging at the beak, and another hole bored diagonally toward the head through the body, emerging at the center of the back.

Size. The length is 4 1/2 inches; diameter of body, 1 1/4 inches.

Decoration. In red, yellow, green, black, and white. The head of the bird is painted solid black with an unpainted zone around the neck. On the back are concentric triangles, from center outward as follows: black, green, red, yellow, white, red, green, black. The wing on either side of the triangular body is indicated by a black parallelogram on which is painted a meander in white. Stripes of green, red, and yellow separate the wings from the solid black triangle covering the under side of the body.

[34] Hough, 1914, pl. 22.

[35] Roberts, 1929, fig. 4.

Hough figures a wooden bird from Greenwood Cave, roughly carved out of softwood, painted "black on the flat surface and yellow below. A white margin is painted on the edge, and a band across the tail."[36]

In the case of the bird from Doolittle Cave, a feather could have been passed through the hole in the head in such a way as to form a beak with its quill end and a crest with its tip, thus imitating the crest of Gambles California quail which is plentiful in this district. The hole drilled through the body possibly was made in order to mount the specimen on a rod, giving it the apperance of the carved bird staffs found by Hough at Bear Creek Cave.[37] The splendid painted wooden bird found by Kidder and Guernsey at Sunflower Cave in Marsh Pass, northeastern Arizona, has converging holes drilled into the under side. There is no way of telling whether it was set on a staff or was suspended from it. Kidder and Guernsey think that the holes were at the wrong angle to have served as sockets for legs.[38]

A different type of bird from Bear Creek Cave in eastern Arizona is made from 2 crossed yucca flower stalk slats sewed together and beautifully painted in 7 colors.[39] Although this specimen is not carved in the round, as are those just mentioned, attention is called to it because of its Upper Gila provenience and because a painted yucca slat found at Doolittle Cave is undoubtedly a wing from the same type of bird (fig. 126, *a*). Many fragments of *tablitas* have the appearance of feathers and may have been attached to bodies of wooden birds.

The bird fetish, either complete or represented by feather-like fragments, is now known to occur on the Pueblo horizon in northern Arizona and as far south as the southern periphery of the Upper Gila area. Its use continues to the present day in Hopi ceremonies.

[36] Hough, 1914, fig. 216.
[37] Hough, 1914, figs. 211–13.
[38] Kidder and Guernsey, 1919, pl. 61; p. 145.
[39] Hough, 1914, pl. 21.

OTHER OBJECTS

LEATHER

Leather Pouches (fig. 127)

Source. Leather pouches, discarded pieces, and occasional strands of sinew were found in 7 caves in the Upper Gila area and 8 in the Hueco area.

Materials. So far as could be determined, the source of leather was from animals which are, in the order of the number of specimens: deer, rabbit, antelope, rodents (prairie dogs and squirrels), coyote or wolf, and porcupine. One piece of porcupine skin furnishes scant evidence as to whether this easilly captured animal was much used. No doubt other animals, such as the badger, were trapped. Threads and cords for sewing were of yucca and cotton.

Technique. Leather, although now stiff with age, was fairly well tanned; 1 piece to the consistency of soft kid. Leather of different thicknesses was cut into serviceable thongs; in the case of the narrow strips of rabbit hide in fur cloth, a sharp flake knife must have been used on a block of wood. As needles were not found, sharp awls were presumably employed for stitching leather.

The photograph illustrates all the complete or nearly complete pouches found, of which all but that in figure 127, *c* (Steamboat Cave) came from the Hueco area.

Pouch a. Chavez Cave; buckskin, flesh side out; sewed with loose-twist yucca-fiber cord; length, 4 3/4 inches.

Pouch b. Ceremonial Cave; shriveled rodent pelt, fur side out; no fur remaining; leg openings tied off with strips of yucca leaves; length, 8 inches.

Pouch c. Steamboat Cave; buckskin, flesh side out; stitched with 2-ply cotton cord; length, 4 1/2 inches.

Pouch d. Chavez Cave; well-cured antelope-neck skin with hair on outside; to close small end, it is first stitched with soft yucca cord, then turned right side out; the large opening closed by wrappings of 8-strand human-hair cord tied with square knot; length, unfolded, 14 3/4 inches.

Shaded pouch e. Cave 1, Hueco Mountains; buckskin, folded upon itself, closely stitched along the side and broader end with yucca-fiber thread; length, 3 3/4 inches.

Pouch f. From Ceremonial Cave; 2 pieces of shaped buckskin laid together and sewed along side and 1 end by long stitches of yucca-fiber thread; 2 cuts or tears mended with same material; dressed side out, showing marks of scraper used to remove hair; length, 9 inches.

The pouch (figure 127, *e*) contains meal and is part of the furnishings of the Basket-maker burial (fig. 64, *b*). In form it resembles the "pollen pouch" from the Basket-maker cave in Kinboko Canyon, found by Kidder and Guernsey.[1] The skin bags from Broken Roof Cave (Basket-maker II) shown by Guernsey, resemble figure 127, *b* and *d*.[2] The pouch *c*, from the Upper Gila, being sewed with cotton, is of Pueblo origin, while the yucca-thread stitching and greater number of leather pouches and bags from the Huecos, one of which was with a Basket-maker burial, seem to fit them into that culture, which comprised quantities of leather containers.

SNARES

Hinged-stick Snares (fig. 128, *b*, *d–f*). Evidence that the hinged-stick snare was in use in the Upper Gila is shown by numerous fragments of round, peeled, or unpeeled twigs with notches at the ends, as in figure 128, *b*. From the Hueco area, the same device is shown at *f*, one-half of a hinged-stick snare with both ends of the rod notched, 1 notch still holding a yucca-fiber cord. The 2 snares, *d* and *e*, from Ceremonial Cave in the Hueco Mountains, are nearly complete. Figure 128, *e*, 5 inches long, is made of 2 round twigs, 1/4 of an inch in diameter, hinged at 1 end with a tie of strips of yucca leaf. At the other ends of the fork are wrappings of the same material, with a loop on one showing how the fiber drawstring attached to the opposite prong and passed through the loop on the other would close the jaws of the trap. Figure 128, *d*,

[1] Kidder and Guernsey, 1919, fig. 85; p. 175.

[2] Guernsey, 1931, pl. 52; p. 74.

8 1/4 inches long, is made in the same manner, but instead of wooden rods thin pieces of yucca bloom stalks are used.

Guernsey and Kidder illustrate a 7 1/2-inch hinged snare from northeastern Arizona, but with the drawcord passing through a hole drilled in the end of 1 prong instead of through a loop.[3] They also mention snares from Grand Gulch, Utah, now in the American Museum, New York, that have the guiding loop, as on figure 128, *e*. This feature also appears on the small, single, bent-stick snares found by Loud and Harrington in Lovelock Cave, Nevada.[4] A 2-rod snare, 6 1/4 inches long, from Nevada is described by Schellbach, which differs from the above in that the drawcord which pulls the rods together is tied at the center of a strand connecting the prong ends,[5] instead of passing through a loop.

Presumably a spring device, such as a bent sapling, jerked the drawcord when a simple trigger of some kind released it, and the jaw-like noose then closed around a small animal.

Objects that seem to be related to snares and to be a part of the trapper's outfit are twigs with the bark still adhering, like figure 128, *a* and *g*, of various lengths, 1/4 to 3/8 of an inch in diameter, which are found in quantity in all caves. It may be that where there existed no natural runways in weeds and brush, twigs with sharpened ends were set in the ground to form wings which would guide the small game into the trap. There is also a possibility that a running noose of hair or fine cord may have been attached to them to capture birds. If used in this way, they may be crude counterparts of the more slender examples found by Nusbaum in southern Utah and described by Kidder and Guernsey.[6] They also mention perfect specimens of this type from the Grand Gulch region, Utah, now in the Museum of Natural History in New York. In describing a bundle of such snares found in a Basket-maker II cave in northeastern Arizona, Guernsey calls attention to this method of catching birds as shown in the decoration of a Mimbres bowl illustrated by Fewkes.[7]

The twig pahos described on pages 124–25 may now have more significance, since decoration of pointed twigs might symbolize parts of snares and cause this type of trap to be more efficacious. The painted, heavy stub pahos (see p. 126) might also represent parts of snares to capture the good will of the spirits.

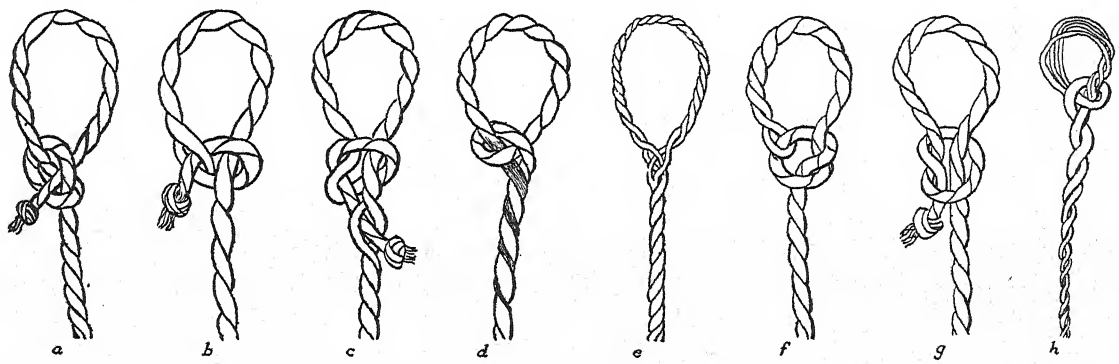


FIG. 42. Types of loops for cord snares. *b*, *g*, provided with running-noose loop; *h*, trigger cord for snare.

Cord Snares (figs. 42; 128, *c*). A bundle of 8 yucca-cord snares came from Chavez Cave and a bundle of 5, made of apocynum fiber, was found at Ceremonial Cave, both in the Hueco area. All are of 2-strand cord, those from Chavez Cave twisted left, while of those from Ceremonial Cave, three are twisted left and two, to the right. The cords usually taper toward the extremities with an overhand knot at each end. Each snare has a loop tied at 1 end. Only figure 42, *b* and *g* are provided with a running-noose loop. The lengths vary from 3 feet 3 inches to 4 feet 9 inches; diameters at center, 3/32 to 5/32 of an inch.

In 1877, Dr. E. Palmer brought to the Peabody Museum 121 noose snares which he found stored

[3] Guernsey and Kidder, 1921, p. 92; pl. 41, *a*.
[4] Loud and Harrington, 1931, pls. 44, *a*, 48, *b*.
[5] Schellbach, 1927, fig. 91.
[6] Nusbaum, 1922, p. 144; pl. XXXII.
[7] Guernsey, 1931, p. 82.

in a corrugated olla in a cave near Johnson, Kane County, Utah. The pottery container would indicate that the snares were the product of a Pueblo III hunter. This assortment includes Type *a* (see fig. 42) and furnishes 5 more types of loops, *c*–*g*. Six of the snares had Type *a* loop, 25 Type *c*, 6 Type *d*, 62 Type *e*, 6 Type *f*, and 4 Type *g*. The 12 remaining snares are not complete. Type *c* is second in representation, while over half the snares have Type *e* loop, a form that cannot be improved upon. All the snares are right-twist with an overhand knot at each end. The cords are smooth and more slender than those of the snares from the Huecos, and in many cases do not have so noticeable a taper at the ends. Diameters average 3/32 of an inch, and lengths run from 6 feet 3 inches to 11 feet 2 inches.

Morss found, in all, 61 running-noose snares at 4 sites in the Fremont River region and also in southern Utah.[8] Of these, 8 have a running noose on both ends but the rest have only the 1 noose. They too are slender like the Palmer snares and range from 6 feet 4 inches to 10 feet 6 inches in length. Type *a* loop predominates, with Type *g*, in which the slide is more apt to bind, coming next; Type *e* is noted in only 1 specimen. In these snares some of the cords are twisted to the right, others to the left.

Trigger Cords. In the bundle of snares from Ceremonial Cave were 2 short tapered cords, each with a small loop on the large end formed by 3 strands bent and then tied with an overhand knot before being combined into a 2-strand cord (fig. 42, *h*). They have been termed trigger cords, because their short length and the type of loop seem to suggest holding a spring which would jerk the snare when released.

If the noose was not laid out on the ground, it must have been half open and supported in some manner. The Palmer snares from Utah give a clue to the material used for spreaders and prove that the loops were suspended from brush or sticks set in the ground, since nearly every one has tied to it several fragments of a species of hair-like *Cuscuta*, possibly *denticulata*. When fresh these threads could have been tied to the noose, yet would break away easily when the trap was sprung.

In the collection we have only the pointed twigs, the delicate spreading threads, and a pair of twisted and looped strings, termed "trigger cords." Hence we still do not know the type of trigger used, the method of attaching the snares to the trigger, or how it was released.

Summary and Variants. Although the Utah noose snares are longer and more slender, and without the noticeable taper toward the ends of the Hueco specimens, they could easily have held the largest jack rabbit.

In the Peabody Museum collection is a modern Paiute noose snare, also collected by Dr. Palmer in 1875. It is a right-twisted fiber cord, tapered and knotted at the ends, with a Type *a* loop. It is 12 feet long, varying in diameter from 3/32 to 4/32 of an inch. The cord is fuzzy and not as smoothly laid, but in every other respect duplicates the prehistoric examples.

As in the hinged-stick snares, slight variations and improvements in the light sliding noose type occur. There is also evidence that larger animals than rabbits were captured by them. The variants in the lighter form referred to are 48 sliding-noose snares with an attached wooden toggle that came from a Basket-maker II cache in a cave in Adugegi Canyon, tributary to Segi-hat-sosi Canyon in northeastern Arizona.[9] In Marsh Pass in the same region are 2 Basket-maker caves reported by Guernsey and Kidder, one of them being White Dog Cave in which was found a light snare having a hollow bone siezed to the end of the cord to make an excellent free running noose. At another near-by site, Cave 6, 3 heavy sliding-noose snares, suitable for big game, were uncovered.[10] The discovery of the sliding-noose snare in Basket-maker sites of western Texas and in northeastern Arizona, and its use through the Pueblo periods and into modern times, proves its antiquity and wide distribution. The hinged-stick snare, which is a form of noose, has an equally wide distribution.

POTTERY

Stratified deposits in the caves, which were never clear cut, furnished poor clues as to the laying down of pottery fragments. In the Upper Gila area, sherds were found at all points in the loose trash; however, in the Hueco area a clearer deposition was observed, for in these predomi-

[8] Morss, 1931, p. 70; pl. 34, *c*.

[9] Guernsey, 1931, pp. 28, 71; pl. 31, *d*.

[10] Guernsey and Kidder, 1921, pp. 29–80; pl. 32, *a*, *b*.

nantly Basket-maker sites, the broken bits of vessels were commonly on the surface or close to it. As might be expected, Mimbres Classic Black-on-white, Mimbres Bold-face Black-on-white (fig. 43), and Mimbres Sharp and Rubbed Corrugated sherds mingled with those of the Upper Gila and Tularosa (which is included with the Upper Gila in this report). In the reconnaissance and excavation of caves, Mimbres Classic and Mimbres Bold-face pottery were noted as fine corrugated of the Tularosa. With these wares were occasional pieces of St. John's Polychrome, black-on-white sherds with ticked-edge figures, and at 1 place a Zuni glaze sherd from the Little Colorado area.

In Playas Valley, or the western part of the Hueco area in extreme southwestern New Mexico, the assortment of cave pottery was meager. It consists of some fine and coarse Mimbres Rubbed Corrugated sherds and light to

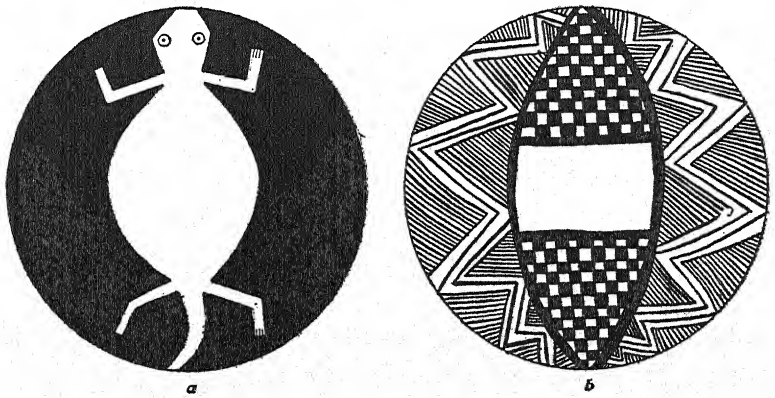


FIG. 43. Bowls from Upper Gila caves. *a*, Mimbres Classic Black-on-white from Doolittle Cave; *b*, Mimbres Boldface Black-on-white from Mule Creek Cave.

far north as Kelly Cave on the San Francisco, and, disregarding its distribution in open sites, as far south as the Hueco Mountains, where in the late surface deposit of Cave 10, 2 Mimbres Classic Black-on-white sherds were found. We think this cave, producing Type 9 plaited turned-heel sandals, which are of the Classic Mimbres period, was used by Mimbreños as a temporary encampment and, judging from sherds found there, was occupied still later by other Pueblo who made El Paso Polychrome ware.

Indicating more northerly contacts were sites in the Upper Gila that furnished the clear black-on-white, red with polished black interior, and reddish- and dark brown-paste sherds with rough to medium-smooth finish, or at times with what might be called a polished surface. Occasionally a smoothed, clear, red-paste ware was noted. All the plain red- to brown-paste sherds are parts of culinary vessels since most of them were heavily sooted. They appear somewhat featureless, yet have the look and feeling of Mimbres as well as pottery from along the international line and from Chihuahua, Mexico. In Cave 6 of this section, an early polychrome type of Chihuahua pottery crept in. In the Huecos proper, besides these plain wares, El Paso Polychrome and Chupadero Black-on-white were secured from cases.

PAINTS

Rubbed pieces of red hematite were found in the caves of both the Upper Gila and Hueco areas; cached in Ceremonial Cave was a quantity of this pigment which had been ground and made into a cake 5 inches in diameter. Although red is the only color represented in the collection, other pigments were applied to prayer-sticks, *tablitas*, and so forth, and were also used in pictographs on the cave and cliff walls. In the combinations of colors, delicate shadings of red and yellow ochers appear, and particularly pleasing are the shades of blue and green derived from the copper carbonates, azurite and malachite, some of them as bright as the day they were applied. With

black, possibly carbon, and the white kaolinite the range of color combinations was quite extensive. Pitch, or the resinous juice of mesquite or piñyon, may also be considered a paint, since in the form of a varnish it was used to decorate some of the *tablitas*, and was applied to reed arrows in delicate combed decorations producing an admirable effect.

PIPES

In the collection are 3 pipes from Ceremonial Cave, Hueco area; one from Doolittle Cave, and one from Steamboat Cave, both sites in the Upper Gila. All are tubular.

Figure 129, *d* (Ceremonial Cave) of basalt is 2 1/8 inches long and 1 3/8 inches in greatest diameter, with only a very slight taper toward the stem end. A tapering hole, 5/8 of an inch in diameter, was drilled in the stem end to meet the apex of a 3/4-inch conical hole, drilled to form a bowl 1 3/8 inches deep. The inside of the bowl is crusted with charred tobacco.

Figure 129, *c* (Ceremonial Cave) of fine-grained tuff is 2 5/8 inches long and 1 inch in greatest diameter. The sides are rubbed smooth and the pipe is rounded, with a noticeable taper toward the stem end; a tapering hole has been drilled entirely through the pipe, 5/8 of an inch in diameter at the large end and 5/16 of an inch at the stem end. In places where a heavy crust in the bowl has flaked away, there are some marks of gouging which show that the drill hole at that end has been enlarged. The pipe is encircled, 1 3/8 inches from the stem end, with a sawed channel 3/32 of an inch wide and 1/16 of an inch deep, possibly for a thong to hold some decorative object.

Figure 129, *b* (Ceremonial Cave) is 2 5/16 inches long, 15/16 of an inch in diameter at the large end, and 1/2 an inch at the stem end. While being shaped, the pipe was rubbed longitudinally on an abrasive and is semi-polished. The drill hole is 7/16 of an inch in diameter at the large end and 5/16 of an inch at the stem end. The marks of the drill have been obliterated by subsequent abrading on a rod. No "cake" remains in the barrel. The material in this pipe, which looks much like catlinite, is the red clay, halloysite, which was used in the manufacture of beads found at the Swarts Ruin in the Mimbres Valley.[11]

Figure 129, *f* (Doolittle Cave) is the stem end of a fine-grained sandstone tubular pipe. The fragment is 2 7/8 inches long and 1 5/8 inches in diameter. The straight drill hole, smoothed by rubbing, is 5/16 of an inch in diameter. The fragment is painted all over yellow with 4 longitudinal panels of red, green, and black stripes. One complete pipe and parts of decorated tubular pipes of this kind were uncovered at the Swarts Ruin near by.[12]

Figure 129, *a* (Steamboat Cave) of native black walnut is 7 1/2 inches long, 2 3/4 inches in diameter at the large end, and 1 1/4 inches at the small end; while the bowl is 2 5/8 inches deep, ending in a 5/32-inch hole. The tubular bone stem is set with pitch in a hole drilled in the small end of the pipe. The opening in which the bone tube is set is 7/8 of an inch in diameter, and it is presumed that this drill hole tapers toward the opening in the base of the bowl. The pipe is elliptic in cross section and is well polished. The bowl is charred and heavily crusted.

The blackened tubular bone (fig. 129, *e*) from Cave 1, Middle Fork of the Gila, is 2 3/8 inches long. It resembles a modern cigarette holder more than a cylindrical bead and it is possible that it may have served as a stem in a wooden or stone tubular pipe.

Hough found a tubular "volcanic stone" pipe in Tularosa Cave (Upper Gila area), a site which produced both Basket-maker and Pueblo artifacts.[13] Nusbaum shows Basket-maker pipes from Cave du Pont in southern Utah which in form resemble some of those from Ceremonial Cave in the Hueco Mountains.[14] The Basket-maker II stone pipe illustrated by Guernsey is more stocky.[15] Wooden tubular pipes also make their appearance in Basket-maker sites, as is shown by Montgomery who records 2 from caves in San Juan County, southeastern Utah.[16] Both are 2 1/2 inches long and 1 1/8 inches in diameter and have the tubular bone stem fastened into them with pitch. One of these pipes was with a Basket-maker burial and the other one was on the same horizon.

[11] Cosgrove, 1932, p. 64.
[12] Cosgrove, 1932, pl. 55; p. 50.
[13] Hough, 1914, p. 111, fig. 247
[14] Nusbaum, 1922, pl. LXIII; figs. 26, 28.
[15] Guernsey, 1931, pl. 34, *f*.
[16] Montgomery, 1894, pp. 228, 230; fig. p. 230.

For comparison reference has been made to the northern Basket-maker stone pipes, which are much like those made by the Hueco Basket-makers. However, the tubular sandstone fragment (fig. 129, *f*), with its striped decoration, is definitely Pueblo, since duplicates of the enlarged cloud-blower form were found at the Swarts Ruin.[17]

The large wooden pipe (fig. 129, *a*) was found in Steamboat Cave in the Upper Gila, where both Basket-maker and Pueblo artifacts were uncovered. From its location in the cave, and from refuse and other specimens near by we were satisfied in the field that it belonged to the earlier horizon; upon learning that similar wooden tubular pipes, though smaller, have been found with Basket-maker burials in Utah, we have no hesitancy in assigning it to that culture.

STONE

Obsidian Projectile Points (fig. 130).

Source. All from Upper Gila (counting those attached to arrows)—Steamboat Cave, 5; Mule Creek Cave, 36.

Material. Obsidian.

Technique. The delicate points indicate careful flaking. Illustrations show forms and the method of retouching and notching the edges.

Size. Lengths are 5/8 of an inch to 1 1/2 inches (majority, 3/4 of an inch to 1 inch); widths at base, 5/16 to 1/2 of an inch.

Attachment to arrow foreshafts is described on page 63.

Miscellaneous Projectile Points (fig. 131)

Source and Quantity. Upper Gila area, 10 (fig. 131, *h–l*). Hueco area, 8 (*a–g*). A few more of the same materials attached to dart foreshafts (figs. 69, 70).

Materials. Varying shades of agate, flint, chert, and rhyolite felsite.

Technique. The workmanship of flaking ranges from good to bad.

Size. Lengths are 1 1/4 to 2 5/8 inches; widths, 1/2 an inch to 1 inch.

The points (fig. 131, *a*, *b*), like some on dart foreshafts, are crude, while others are well made. Figure 131, *a–d* seem to be dart-points. By comparison with points on foreshafts from Ceremonial Cave, now in the Alves collection, *c* seems to represent 1 type of dart-point that can be recognized as Hueco Basket-maker. With the exception of the base, which is not concave, the point *d* somewhat resembles those found to the southeast on the Pecos River. The rest of the specimens are probably broadheads for arrows.

Only 1 dart foreshaft in the collection is tipped with obsidian. The absence of large obsidian nodules in the region, as well as the brittleness of obsidian, may explain why this material was seldom used. The crudeness of some of the points may indicate hasty repair and re-use of the darts. Examination of the points on foreshafts (figs. 69, 70) shows that in the 2 areas there was no standard form used on this type of projectile.

Knives (fig. 132)

Source and Quantity. Four complete specimens and several bases and points of knife blades from Upper Gila and Hueco areas.

Materials. Figure 132, *a*, flint; *b–d*, rhyolite felsite; *e*, agate; *f*, *g*, flint.

Technique. Some carefully flaked, others rather rough.

Size. Figure 132, *a* is 2 5/8 by 1 1/8 inches; *d* 4 1/4 by 1 1/2 inches; *e*, 5 3/8 by 1 3/4 inches; *g*, 2 1/4 by 2 5/8 inches in diameter.

The blades for hafting are leaf shaped. Figure 132, *a*, whose base is narrowed to somewhat of a tang, could have been used either as a knife or a point for a dart. The points (*b–d*) are crude and rough, and the edges of *d* rather dull, apparently having been chipped by percussion. The blade (*e*) of reddish-brown agate is a fine specimen with keen edges and a sharp, beveled point. The base still retains particles of pitch used in cementing it into a handle. Figure 132, *g* is a large flake with 3 sharp retouched edges. This knife was held by the fingers and is now discolored on both sides with yellow and red ocher.

In all caves were numbers of keen-edged stone flakes which no doubt were used as blades to shape wooden objects. Cores from which these chips were struck and occasional thick leaf-shaped rejects were also found.

[17] Cosgrove, 1932, p. 50; pl. 55.

Scrapers (fig. 133, *a–f*). These were found in the refuse of many caves in both areas; made from large and small flakes with 1 or 2 edges retouched for sharpness.

The scraper (fig. 133, *c*) with serrate edge might be termed a saw. The edges of *d* were flaked back 3/8 of an inch to 1/2 an inch as means of thinning before they received the final retouching; the scraper *e*, from the Upper Gila resembles the so-called "duck-bill," Plains type, but it is not perfectly flat on the under side to give the thick end a sharp working edge.

Arrow Straighteners (fig. 133, *g*, *h*). There are only 2 in the collection: *g*, from Cliff House 1, West Fork of the Gila; *h*, from Cave 5, Sipe Canyon in the San Francisco drainage.

Figure 133, *g*, a smoothed river stone of porphyritic rhyolite, has a shallow polished channel worn across it; *h*, of schist, is darkened by fire, and the face as well as the channel is highly polished.

Examples of arrow straighteners are rare even in arrow-making Pueblo sites in the Upper Gila. None was found or reported from the Hueco caves, even though a few fragments of arrows have been reported from some of them in the past.

Stone Hoes (fig. 134, *a*)

Source and Quantity. Upper Gila area—Doolittle Cave, 6 complete, 24 fragments.

Material. Thin plates of olivine andesite.

Technique. Formed by blows of hammerstone which removed flakes from both sides of the plate.

Shape and Size. Lengths are 5 to 8 inches; widths at base, 2 to 2 1/2 inches; thickness, 1/4 to 7/16 of an inch. The blades are leaf shaped, occasionally with a straight base, but more commonly rounded. On several of the specimens 1 or both sides have been smoothed and the points of 2 are thinned and show polish.

This cave is near the Swarts Ruin in the Mimbres Valley, where numbers of such objects were discovered. They seem to be agricultural implements peculiarly common in this area.[18] Unfortunately no withes or handles were found in the cave refuse to indicate the method of hafting.

Axes (fig. 134)

Source and Quantity. Upper Gila area—Doolittle Cave, 1. Hueco area—Chavez Cave, 1; Cave 1, 1.

Figure 134, *e*, from Doolittle Cave, is a piece of felsite with 1 flaked, beveled edge, which, due to its thickness and weight, is judged to be a fist axe. Figure 134, *b*, from Cave 1, Hueco Mountains, is also a piece of felsite changed in color on the outside by weathering. There are no grooves for hafting, yet the dulled, flaked cutting edge shows that it was used as a chopping tool. The three-quarter-grooved axe (*c*), of basalt, came from Chavez Cave. It has an additional channel across the head from side to side and represents an improvement in hafting, a form of axe common in Pueblo sites of this area. The handle *d*, from Chavez Cave consists of 3 withes which at 1 time held a small axe or club head. It is the only example of hafting in the collection. What might be termed a Basket-maker form of axe is yet to be discovered. It is certain that the Hueco Basket-makers had a cutting tool of some kind to fell good-sized oak saplings from which they made their grooved fending sticks.

Hammerstones. Discarded hammerstones, 2 1/2 to 3 1/2 inches in diameter, were dug out of caves in both the Uper Gila and Hueco areas. The more or less uniform wear on this common implement, which served so many purposes, prevents a classification which might aid in placing the several types in different periods.

Metates and Manos. Thirteen sites (cliff dwellings and caves), 12 of which were in the Upper Gila area, produced either metates or manos. Where the metate was missing, the form of the manos determined the type of metate used. Among such specimens were 11 large stones having either flat or slightly concave, worn surfaces. There were 10 Type 2 metates, i.e., with an enlarged oval depression ground into the working face by the action of the turtle-back rocker-bottom mano.[19] Aside from these there were 3 Type 4, trough-shaped metates, 2 from sites in the Upper Gila immediately adjacent to arable land, the other from Cave 6 (Pinnacle Cave) along the Mexican line, an area where the flat-bottomed metate is most in evidence.

[18] Cosgrove, 1932, p. 45; pl. 44.

[19] This is in accordance with the developmental series found at the Swarts Ruin. Cosgrove, 1932, p. 55, pl. 32.

It is reasonable to assume that in the less accessible mountain sites, any convenient flat stone or rounded boulder would be utilized in grinding, with the result that the Type 2 metate, which at the Swarts Ruin was considered earlier, was in the majority, whereas in some cases, when the shelter was not quite so hard to reach and was close to the field, the later, more perfected Type 4 metate, with the flat, oblong mano, made its appearance.

Rubbing Stones (fig. 135)

Source and Quantity. Shelters in both areas—Upper Gila area, 3. Hueco area, 9.

Materials. Rhyolite and sandstone.

Technique. Only 2 specimens have been worked, the rest being unshaped stones 2 1/2 to 5 inches long which were picked up in arroyos or at outcrops. Figure 135, *f*, ovoid in outline, shows marks on 1 end of the pecking hammer, as does *e*, which was shaped by this process into a more rectangular form. Flat and rounded surfaces are seen on one or both sides of stones in the assortment. Figure 135, *e* has beveled faces worn from a median line on both sides. Figure 135, *a* and another round stone with flat face are discolored with red and yellow oxides. From the general appearance of these artifacts and the wear on their surfaces, it seems reasonably certain that they were used by nomads, probably for dressing leather, pulverizing paint, sanding wood, and grinding food.

Small Mortar (fig. 136, *d*). From Chavez Cave, Hueco area, comes a small circular mortar, 2 3/4 inches in diameter, made of spongy light vesicular basalt. There is no discoloration in the bowl from pigment, as sometimes occurs in like objects found in the area.

Pestle (fig. 136, *a*). One large pestle was found in Ceremonial Cave in the Hueco Mountains. It is made of amphibolite schist, 13 1/2 inches long, 1 3/4 inches thick, and 2 1/2 inches wide. Apparently this pestle was taken back and forth from places where mesquite beans or corn were cracked in large mortars, for it is provided with a carrying harness of stripped yucca leaves.

Stone Ball (fig. 136, *b*). A stone ball from Chavez Cave is so perfectly made that it must be mentioned. Two inches in diameter, it was rounded by the pecking or crumbling process. Whether it was used in games or for some other purpose can only be surmised.

Tablets or Plaques (fig. 136, *c*). Six tablets were found in caves of the Upper Gila: 3 in Doolittle Cave, 2 in Lone Mountain Cave, and 1 in Kelly Cave. The first 2 sites are in the Mimbres drainage and the latter in the San Francisco River country. All are small plates of slate or shale ground into rectangular form, the two from Lone Mountain Cave being notched on the edges. The faces show a slight depression, worn into them. Numbers of tablets have come from the Upper Gila area. Those found at the Swarts Ruin are described in a report on that Mimbres site in which it is suggested that they had a ceremonial usage and considerable antiquity, since some were found below floors of early plaster-on-soil pit rooms.[20] Two of the caves, and especially Doolittle Cave, were at 1 time Pueblo shrines, so that there is now additional evidence of the religious significance of these tablets. There is nothing to show that those found in caves antedated Pueblo times.

Painted Stones (fig. 136, *e*, *f*). A small thin plate of sandstone from Doolittle Cave on the Mimbres and a piece of limestone from Cave 1, Hueco Mountains, were the only objects of this kind found. The standstone plate (fig. 136, *e*) is striped with 1/4-inch bands of yellow, red, and black, similar to a fragment of sandstone pipe from the same place. On a smooth surface of the chunk of limestone (*f*) is painted in black a small animal 1 1/4 inches long which resembles a deer, though the legs are articulated in the wrong direction. Although the stone showing the animal was not stratigraphically located, it was found in a cave which yielded a Hueco Basket-maker burial. A plain brown sherd, lying on the surface, was the only evidence of later visitors coming to the shelter.

Summary. Stone artifacts present a rather baffling problem in the segregation of those which might be of Basket-maker origin. Several which can be identified with comparative safety as Puebloan are the delicately flaked obsidian arrowpoints, arrow shaft straighteners, hoes, painted, flat pieces of stone, and stone tablets. Among the larger projectile points are examples suggesting those used on the heavy darts, but taken as a

[20] Cosgrove, 1932, p. 51, fig. 5; pl. 56.

whole, they do not conform to any standard as to outline, position of notches, etc., as do the points discovered in northern Arizona.

An example of what has been termed a fist axe came from an Upper Gila cave, and another crude implement without grooves from the Hueco area. Because of the scarcity of material, we are still in the dark as to the form of Basket-maker chopping implements, although such a sharp tool must have been necessary in roughing out some of the implements of very dense hardwood. Coffin describes a part of what appears to be the poll of a grooved maul, but this was probably a late importation into Bee Cave, as was an excellent specimen of a three-quarter-grooved axe found by us at Chavez Cave on the Rio Grande. If axe heads capable of being hafted with or without grooves had formed part of the equipment of the Big Bend Cave Dwellers, they would surely have been noted in reports of investigators from that district.

The rubbing stones (some of which might have been manos for crude metates), the hammerstones, knives, flake scrapers, and other stone objects could be placed in any period. So again we encounter artifacts which, though necessary, cannot be assigned to any one period.

The significance of the painted pebbles, none of which appeared in the Upper Gila or Hueco areas, but were found in numbers in the Big Bend, is yet to be determined. They appear to be peculiar to the latter area.

WOOD

Woodworking (fig. 137). The art of woodworking was the same in both the Upper Gila and Hueco areas, where numbers of rejected pieces were found in the caves. The methods were (1) chopping; (2) whittling; (3) shaving and planing; (4) sawing; (5) splitting; (6) gouging and scoring; (7) scraping and sanding.

Chopping for felling and sectioning was presumably done with the crude fist axe in the early periods and later with the hafted axe. Marks of these tools show distinctly, and the cuts on some specimens indicate the use of a very sharp bit. The tree or branch was chopped on all sides well toward the heart and then broken off, as in figure 137, *k*, *l*. Flattened pieces of hardwood were also sectioned in this way.

Whittling was very common, especially on small branches. The process was to whittle to a given point with a sharp stone flake, and when the cutting on all sides had reached nearly to the center, to break the piece in two. This process is shown by the discarded pieces (fig. 137, *c–f*, and *j*) to which the shavings still adhere.

Shaving specimens (fig. 137, *h*, *m*) illustrate this process, which is remarkable in that a piece of heavy, dense hardwood could be planed and show so few marks of the stone tool. The bundle (*n*) indicates the fineness of shavings resulting from this process.

Sawing, either with a sharp flake which chips easily and becomes serrated, or with a thin piece of abrasive stone, was common in sectioning wood (fig. 137, *b*, *g*). From marks of blows of a sharp-edged tool, showing on the lower end of *h*, it can be seen that the process of sawing was hastened in some cases by a preliminary bruising of the wood.

Splitting the dry, straight-grained sotol or yucca bloom stalks into thin laths would be easy with a sharp stone flake. However, there are no tools to show how oak or other tough woods were riven. Possibly it was accomplished with a stone axe after the billet became checked in drying. Figure 137, *m* is one of a number of severed ends from unfinished fending sticks found in the Huecos that may have been split out in this manner. The flattened fragment, 3/8 of an inch thick, is from a block 1 3/4 inches in diameter, and if planed down to this thickness would have required unnecessary labor. A segment has been split from both sides.

Gouging or Chiseling with a delicate stone implement can be seen in the toughs in atlatls. The incised lines on fending sticks indicate the use of a keen-pointed stone routing tool.

Scraping with a keen-edged instrument, or rubbing on or with an abrasive stone, completes the series of woodworking operations. The simple, yet ingenious, method of notching a dart foreshaft is described on pages 52, 54 and shown in figure 71.

Dart Wrenches (fig. 138, *a*, *b*)

Source and Quantity. Hueco area—Ceremonial Cave, 6 specimens; Chavez Cave, 1.

Materials. Oak, bloom stalk of yucca, antler.

Technique. In the 5 wrenches made from sections of discarded oak grooved fending sticks (fig. 138, *b*), and the one made from a piece of 1 1/2-inch split yucca bloom stalk, charring shows that the wood was perforated with a glowing ember. This perforation is near the end of the stick; the sides of the holes are usually worn to a decided bevel and polished from the sliding of dart shafts through them. On the wrench (*b*) the beveling is to 1 side. The antler wrench (*a*) was severed from the horn by being scored or sawed with a stone flake, then broken loose. The hole which probably was drilled with a stone point is as much beveled as those in the wooden wrenches.

Size. There is no uniformity in size; the wooden wrenches vary from 9 1/2 to 11 inches long; antler wrench, 5 3/4 inches long. The hole through the wrenches measures 3/4 of an inch in diameter.

Smith shows 14 inches of the proximal end of a grooved fending stick converted into a dart wrench which came from the general west Texas region.[21] Alexander and Reiter, an antler wrench from the Jemez Cave in northwestern New Mexico;[22] Nusbaum, a horn wrench from southern Utah, which has a 9/16-inch hole through it.[23] Horn specimens from northern Arizona now in the collection of the Peabody Museum have holes 5/16 of an inch to 7/16 of an inch in diameter, which are too small for the regulation dart. The wrench from west Texas duplicates those from the Hueco Basket-maker caves, while the horn wrench from Utah, with a 9/16-inch hole, would be large enough to straighten dart shafts. It is, therefore, thought that the size of the hole and the marks of wear on it place this tool as part of the dart-maker's equipment and not that of the arrow-maker, for such a heavy implement would not be necessary in straightening slender arrow shafts. By test, the finished darts found in the same caves fit the wrenches perfectly, and it can be seen that the sides of the holes would become beveled and polished from use. Confirming the use and wear on such an implement, the sotol dart from the Huecos, described on pages 50, 51, shows clearly the marks of the sharp edges of a newly drilled straightener.

The Kane County Cave, Utah, was a straight Basket-maker site, and it is strange that in the rest of the northern area, at one time so thickly populated by Basket-makers, there have been found numbers of wrenches or straighteners of a size to fit arrows but almost none suitable for darts.

Tree-shell Trowels (figs. 138, *c*, *d*, *i*, *k*)

Source and Quantity. Upper Gila area—Kelly Cave, 1 complete and 2 fragments. Hueco area—Ceremonial Cave; Cave 6; Chavez Cave—5 complete and 7 fragments.

Material. Some light wood, apparently cottonwood.

Technique. Little shaping is seen on the irregular flakes broken from the log. Some are narrow at one end, but never worked down into a regular hand-hold. An exception is the thin, oblong flake (fig. 138, *c*), which seems to have been rubbed into a somewhat regular form of which the slightly concave surface shows gouge marks. On the convex surface of 3 other fragments, there are marks of the same sort of tool. The edges are rounded and worn from digging, and the concave surfaces are charred, at times showing pits as if burned with live coals (*d*), suggesting their use in handling embers for parching food.

Size. The lengths range from 7 to 17 1/2 inches; widths, 2 to 5 1/2 inches at the widest point.

Until recently, little interest has been shown in this crude tool from the Hueco-Big Bend country, of which many specimens must have been overlooked, or at least not mentioned in reports. Mrs. Alves records a charred wooden "shovel" from Ceremonial Cave;[24] Howard found a "bark scoop" near Guadalupe Peak in Culberson County, Texas;[25] and Setzler found them in the Big Bend region.[26] Hough shows a trowel from the Blue River in the Upper Gila area.[27] Guernsey and Kidder were the first to describe the tree-shell trowels from northern Arizona and to call attention to their occurrence in Basket-maker II caves.[28] Later, Nusbaum discovered them at a Basket-maker II site in southern Utah;[29] and farther north in Utah, Morss mentions wooden scoops from the Fremont River country, but assigns them to Basket-maker III.[30] The trowels from the Upper Gila and the Huecos are identical with those from northern Basket-maker sites, and

[21] Smith, 1927, fig. 2.
[22] Alexander and Reiter, 1935, pl. X, *u*; fig. 9; pl. 38.
[23] Nusbaum, 1922, pl. LXI; p. 123.
[24] Alves, 1932, p. 22.
[25] Howard, 1930, p. 194.
[26] Personal information in 1932.
[27] Hough, 1914, pl. 14, no. 2; p. 63.
[28] Guernsey and Kidder, 1921, pl. 38, *g–i*; p. 90.
[29] Nusbaum, 1922, pl. LIX; p. 115.
[30] Morss, 1931, p. 63.

that they pertain to that culture is further emphasized by the fact that all caves in which our specimens were found contained unmistakable evidence of the Basket-makers.

Wooden Ladle (fig. 138, *e*)

Source and Quantity. Hueco area—Cave 5, 1 fragment.
Material. Segment or flake split from softwood log.

Technique. The specimen has been hollowed out with a tool, and the convex outer surface abraded into shape. The end is squared and the interior is charred; there are no marks of fire on the outside.

Size. The width is 3 1/2 inches, but we have no means of determining the measurement of the original length.

This ladle was found in a cave producing typical Hueco Basket-maker sandals, also Pueblo potsherds. The utensil with charred interior suggests a variation of the Basket-maker tree-shell trowel, although it may be of later origin than the tall-shell trowel.

Boards (fig. 138, *j*)

Source. Upper Gila area—Lone Mountain Cave. Hueco area—Cave 3, Deer Creek.
Material. Three shells of softwood.

Shape and Size. The fragment (fig. 138, *j*) from Deer Creek Cave has rounded edges. Near 1 side edge, 2 1/2 inches from the corner, is a 1/2-inch hole. The board is rectangular in form, 5 1/2 inches wide and 1/2 an inch thick.

The decayed fragment from Lone Mountain Cave has a slightly convex front and back, with edges rounded; width, 5 inches; thickness, 5/8 of an inch at center, 1/2 an inch at edge.

Both caves were Pueblo sites. The specimens are somewhat like boards with holes in the corners taken from cliff ruins in northern Arizona by Kidder and Guernsey,[31] also by Morris at the Aztec Ruin.[32] Like those authors, we are unable to suggest the use of these rectangular boards. A guess might be that they were stretchers on which to cure small animal hides.

Pitch Daubers (fig. 138, *f–h*). At Kelly Cave in the Upper Gila and at Cave 7 in the Hueco Mountains, a number of sticks with pitch-coated ends were found. Any convenient twig or wooden splinter served to stir the molten substance and probably also to apply the pitch to baskets in the waterproofing of them. Most specimens came from the very dry Huecos, where it was noted that pitch-coated baskets and basketry water jugs were much used (p. 108). Mention has also been made of the use of melted resins or the soluble mesquite gum in the decoration of reed arrows (pp. 64–65).

Small Wooden Tools—Awls (fig. 139, *b, e–h*). Four of these were found in the Hueco area and 1 in the Upper Gila area. They are slender hardwood twigs, 6 to 8 inches long and 1/8 to 5/16 of an inch in diameter, with ends tapered by sanding and points polished by use. The more slender tools probably were used in the manufacture of baskets. Large thorns, like figure 139, *b*, also served in fine work, one having been found in the bag from Ceremonial Cave (fig. 99, *a*).

Spatulate Tools (fig. 139, *d, j*). These specimens came from the Hueco Mountains. Made of pieces split from hardwood branches, they vary from 8 3/4 to 10 inches in length. The tapering thinned ends are smoothed, and the edges slightly rounded and polished by use. These tools may have been used in the weaving of baskets or matting, since their thin blades are not strong enough for heavier work.

Crochet Hook (?) (fig. 139, *i*). Cave 1, Middle Fork of the Gila, a broken specimen 7 inches long, original length unknown. The hook at the end suggests that the object may have served as a crochet needle for handling the strands in loose open textiles; it might, however, be the distal end of a crude atlatl.

Hafted Tool of Unknown Use (fig. 139, *a*). Kelly Cave in the Upper Gila area; small twig, 3 1/4 inches long and 5/16 of an inch in diameter; a notch at 1 end into which is set a fragment of gourd rind, held in place by a wrapping of stripped fiber.

Fire-making Apparatus (fig. 140)

Source and Quantity. Sixty drills, 86 hearths, and several torches from both the Upper Gila and Hueco areas.

Materials. Eight drills of hardwood, rest of yucca bloom stalk (some in Upper Gila possibly flowering stalks of bear grass, *Nolina microcarpa*); all hearths of yucca except 2 of juniper or cedar; torches of shredded cedar bark.

Technique. The long drills are made of the straight, tapering, upper portions of bloom

[31] Kidder and Guernsey, 1919, pl. 46A, *b;* p. 119.

[32] Morris, 1919a, p. 46.

stalks or twigs. Usually the leaf scars have been removed and the shaft smoothed. In Ceremonial Cave in the Hueco Mountains, many proximal ends of broken sotol darts were converted into drills. The lengths vary from 12 to 29 inches; diameters at round point, 1/4 to 7/16 of an inch (majority, 3/8 of an inch). The short, tapering drill heads of yucca are 2 1/4 to 3 1/2 inches long; diameters of points, same as long drills.

The hearths are commonly round, semicircular, or flat pieces of wood, split from yucca bloom stalk. In the Huecos some are made from broken dart shafts (fig. 140, *j*). Six hearths are smoothed and worked into oval form. One (*h*) is the only one in the collection with finished ends. It is 5 inches long and has a groove at 1 end to hold a suspension cord. The first socket was always at 1 end, and others may continue along the stick as the preceding ones wear through (*i*). Lengths of the uncut sticks vary from 9 to 17 inches.

Discoloration on the drills shows that they were rolled between the palms of dirty hands, and there are no marks on them to indicate that they were revolved by the use of a thong or string. It appears that the next step after smoothing the shaft was to round the end. The bottom of the hole in the hearth (fig. 140, *g*) points to the occasional use of a drill with a cupped end. As no drilling was done with reeds in this area, a drill that would leave a ring was very likely made of a twig with a pithy center.

The short drill heads have round points like the longer drills. Marks on their tangs (fig. 140, *b*) prove that they were set into a reed as were the foreshafts of arrows. A Paiute drill illustrated by Hough is assembled in this way and has the advantage of a straight shaft.[33] No specimens of short drill heads came from the Hueco Mountains; one was found at Sandal Cave, near San Marcial, the rest in the Upper Gila area.

Usually in preparing hearths, a slight depression was cut in the surface to keep the drill from creeping before it seated itself as in figure 140, *e*. Next, a slot, or squared channel, was cut in the side of the stick well into the preliminary depression. The purpose of the channel was to carry the hot powdered wood into the prepared tinder. On a number of specimens no channel was made at the side, and the drill, started close to the edge of the yucca hearth, would quickly wear through the round back, forming a small opening at the side of the drill hole that would let the powdered wood escape. On account of the softness of the yucca bloom stalk, it is very likely that only 1 or 2 fires could be started with such a hearth before it was perforated. Another variation is shown on the convex side, or back of the hearth (*f*). The drill hole was started as described, but instead of making a channel on 1 side, the workman cut away the back of the hearth below the drill hole, thinning it considerably, so that a slender sharp point left on the end of the drill would puncture it immediately, allowing the powdered wood to fall through a small opening in the bottom instead of working its way down a trough. From the shape of its end, the drill (*d*) must have been used with this type of hearth. The slender point would stay intact and the shoulder thus formed would take the wear as the drill worked its way through the hearth.

The bundles, like figure 140, *k*, of shredded cedar bark tied with a strip of yucca seem to have been used as torches, since all are charred at the large end. It is thought that they have some connection with firemaking and were ignited from the tinder. The material when bound together does not flame violently but live coals are generated that would quickly start leaves and kindling burning. Experiment shows that this glowing, slow torch is practical to start a blaze, also that fire can be carried with it for a considerable distance, although it is worthless for illuminating purposes as the bark does not flame like a pine knot. For this reason, torches have been included with other firemaking apparatus.

Hough describes the various methods of firemaking and places the "simple two-stick apparatus" as being the most widespread. He reasons that it is the earliest form and considers it is derived from the primitive flint drill.[34]

The use of yucca bloom stalks for firemaking in semi-arid countries is widespread. South of the Huecos, both Smith and Coffin report fire tools of this material from the Big Bend country of Texas.

In checking the number of fire-making drills and hearths in the collection, it was seen that two-thirds of these came from shrines, the Doolittle Cave in the southern part of the Upper Gila area and Ceremonial Cave in the Hueco Mountains. None of the specimens from either area shows signs of having been decorated as a fetish, yet the quantity in the caves of this character,

[33] Hough, 1928, fig. 8; p. 16.

[34] Hough, 1928, pp. 2–4.

where there was little to show permanent habitation, seems to indicate that firemaking was of ritual significance.

Grass-seed Flail (?) (fig. 65, *w*). A bundle of 5 slender, peeled hardwood sticks tied together near the center with wrappings of sinew came from Ceremonial Cave. The only complete pointed rod in the bundle is 15 1/2 inches long; the others were cut away by rodents. Suggested use of this specimen is tentative, and although the rods are not as long nor are they fastened together at the end to form a grip like those figured by Kidder and Guernsey, it is possible that it may have served as a flail.[35]

Planting Sticks (fig. 141)

Source and Quantity. Upper Gila area—Doolittle Cave; Greenwood Cave; Steamboat Cave; Mule Creek Cave—25 specimens. Hueco area—Chavez Cave; Ceremonial Cave—32 complete and fragmentary.

Materials. Different varieties of heavy hardwood, such as oak, mesquite, tornillo, mountain mahogany.

Technique. The limbs were severed from the tree by chopping with a sharp-edged stone implement. The small end of the stick, which is the hand-hold, is at times smoothed and rounded and the bark is often left on the sticks. The small branches were lopped off by blows of a sharp-edged tool, and the digging end, whether flat or round, was shaped with the same kind of instrument.

Shape and Size. There are 8 sticks with flattened digging end; the rest have been cut to sharp points; among these are 6 having digging points at both ends. Only 1 specimen has a natural crook in the wood converted into a comfortable hand-hold. The points show wear and sometimes considerable polish. The lengths of the complete specimens of ordinary planting sticks vary from 23 1/2 to 37 1/2 inches; average diameters, 5/8 to 3/4 of an inch. Those of tornillo wood (fig. 141, *e*, *f*) are 46 1/2 and 59 3/4 inches long; diameters, 1 1/2 and 1 3/4 inches, respectively. These 2 exceptionally large and naturally crooked planting sticks from Chavez Cave, formerly a Basket-maker site, are like the Basket-maker tools from northeastern Arizona described by Guernsey and Kidder as type specimens.[36] Some of the more slender and straighter sticks without knob handles from the Hueco Basket-maker sites are also typical of the Basket-maker implements described by those authors.[37] Part of the heavy planting stick (*g*), also from Chavez Cave, has been destroyed by fire, the remaining piece being 30 inches long and 1 1/4 inches in diameter. The material is the same as the tools (*e* and *f*), but the end comes to a point instead of a flattened blade. The sharp point is highly polished and the tool would make a dangerous weapon as well as a serviceable agricultural implement. The Chavez Cave planting sticks, from their association with other Basket-maker artifacts, are known to be early, and resemble the northern Basket-maker tools. However, shape is not always conclusive evidence of age, for planting sticks with either sharpened or flattened digging points continued to be used in later times, as they have been found in caves of Pueblo occupation on the Upper Gila.

At Mule Creek Cave on the Upper Gila, where many ceremonial objects were deposited, there were a number of planting sticks, four of them so elaborated as to suggest that they were offerings (fig. 141, *b–d*, *j*). The stick (*j*), 27 inches long, 3/4 of an inch in diameter, is large enough for practical use. It has been coated green with copper carbonate for 11 inches from the proximal end, over which were laid bands and indistinct angular figures in black. From this zone to the pointed end it is painted red with oxide of iron pigment. The miniature planting stick (*a*), from Chavez Cave, made of mesquite or tornillo, is pointed at 1 end only and is rubbed almost to a polish. The length is 19 1/2 inches; diameter, 7/16 of an inch. The decoration consists of 7 irregularly spaced incised zigzag lines encircling the rod. The zigzag lines are a Basket-maker trait, as seen on the small atlatl (fig. 68, *c*) found at the same site. The stick (fig. 141, *b*) is an unpainted hardwood twig with 1 end pointed, the other shaped into a flattened blade. The length is 14 3/4 inches; diameter, 3/8 of an inch. Four and one-half inches from the broad end, the remains of a quill in a knot of soft cotton string wrapped around the stick show that originally a feather had been attached to it. The unpeeled stick (*c*), which seems to be of wild cherry, is pointed at 1 end and has a flattened blade at the large end. The length is 18 inches; diameter, 3/4 of an inch. Four

[35] Kidder and Guernsey, 1919, p. 120; pl. 48.
[36] Guernsey and Kidder, 1921; pl. 37, *g*.
[37] Guernsey and Kidder, 1921, pl. 37, *b–d*.

and three-quarters inches from the large end, an inch band of bark has been peeled from the stick as a decoration. Nothing remains to show that feathers had been tied to it. On the slender planting stick (*d*), a peeled and scraped hardwood branch, only 1 end is pointed. The length is 25 1/4 inches; diameter, 1/2 an inch. The entire stick is painted red with oxide of iron. Eight and one-half inches from the blunt proximal end is a 3/4-inch whipping of fine cotton thread which still holds the quill of a downy feather.

The 5 specimens just described, 3 being miniature replicas of the standard planting stick, show that supplications for bountiful harvests played an important part in the religion of these early agriculturalists.

Wooden Stoppers (fig. 66, *d*, *e*)

Source and Quantity. Several specimens from both Upper Gila and Hueco areas.

Material. Softwood, commonly the flower stalk of the yucca.

Technique. The sections are cut to length and tapered at 1 end by scraping and sanding.

Size. The length varies from 1 1/2 to 2 inches; diameter, 7/8 of an inch to 1 1/4 inches. Stoppers must have been used to close holes in gourd or squash containers, since pottery canteens or bottles were not made in this area. The bird-form vessel of Tularosa ware, with a rather large orifice, is the nearest approach to the small-mouthed canteen.

GOURDS

Gourd and Squash Containers (fig. 66, *c*, *g*, *h*)

Source and Quantity. Many fragments, some large pieces, from both the Upper Gila and Hueco areas.

Materials. Gourd and squash. Botanical: Identification of the varieties of gourds and squashes represented by the specimens has not yet been made, the appearance of any difference between these 2 areas would be of first importance.

Technique. Although none of the pieces retains any part of an orifice, it is evident that the shells served as receptacles, for many fragments have drill holes through which fiber-cord or yucca-leaf strips were sewn when they cracked in use (fig. 66, *c*). No attempt was made to decorate them, and they seem to have been an everyday household article.

BONE

Awls (fig. 142, *c–i*)

Source and Quantity. Upper Gila area—Doolittle Cave; Steamboat Cave; Site 7, Sapillo Creek Canyon Cliff Ruin; Cave 2, West Fork; Mule Creek Cave; Cave 4, Goat Basin; Brushy Mountain Cave—11 specimens. Hueco area—Chavez Cave; Ceremonial Cave; Caves 2, 6, 7—21 specimens

Materials. Principally metapodial bones of deer or antelope; 1 awl of deer ulna and 1 of coyote ulna; leather and stripped yucca leaves as pads.

Technique. The metapodial bone is usually split, with either the proximal or distal end left as a handle, and the shaft has been pointed on an abrasive stone. Some points are very slender (fig. 142, *c*). On blunted awls a new slender point was obtained by notching 1 side and cutting away the surplus bone beyond the notch. Bone splinters were used to make sharp awls. One awl shows a piece of leather thong for suspension still in place in a hole bored through the condyle. Another awl (*e*) is padded with a leather cap held by strips of yucca leaf and still another (*h*) is wrapped at the end with strips of yucca leaf. There is no attempt at decoration even of the simplest character.

Size. Lengths vary from 2 3/4 to 7 inches (majority, under 5 inches).

These awls are similar to the general Pueblo III types. Some of the shorter ones, and especially that with a leather cap and that with fiber wrappings, are similar to the northern Basket-maker type, and well may be such, since they came from caves in the Huecos where Basket-maker artifacts were found. It is not surprising that two-thirds of the specimens should have come from

the Huecos, since that area produced more basketry than the Upper Gila and the bone awl was the basket-weaver's most necessary tool.

Flaking Tools (fig. 142, *j–o*)

Source and Quantity. Upper Gila—Doolittle Cave; Steamboat Cave; Sapillo Creek Canyon Cliff Ruin; Mule Creek Cave; Kelly Cave. Hueco area—Ceremonial Cave—6 specimens in all.

Materials. Bones and horns of deer or antelope.

Technique. Sections from the outer compact tissue of the heavier bones or antlers are shaped into long, flattened tools. Some, however, tend to be elliptical in cross section, since the edges and 1 end are rounded. The working end is either beveled on both sides or ground to a blunt point (fig. 142, *k–n*). On undressed antler tips, like *j*, there is no work other than grinding the point.

Size. The lengths vary from 2 3/4 to 4 1/2 inches; widths, 3/8 to 3/4 of an inch.

The flat tools may have been hafted and the rounder ones grasped by the fingers. One flat piece (fig. 142, *n*) of naturally curved antler can be conveniently held in this way. All are presumed to be pressure flakers, because they show no evidence of having been struck with a mallet.

Bone Weaving Tools (fig. 142, *a*, *b*). The tool (*a*), from Chavez Cave, Hueco area, is made from a 5-inch fragment of animal rib. It is called a weaving tool, because of shallow notches worn on both edges, and the fact that its concave side, the edges of the rib, and the notches are polished from having been rubbed on a soft substance. The well-finished, pencil-shaped bone object (*b*) seems to have served for the weaving of soft fabrics rather than basketry.

ORNAMENTS

Wooden Pins (fig. 143, *l*)

Source and Quantity. Upper Gila area—Steamboat Cave; Site 1, Mogollon-Sapillo section—12 specimens.

Material. Hardwood.

Technique. The bark has been scraped from small twigs cut into short sections with a sharp stone flake. For about two-thirds of their length they have been reduced by whittling to produce a cylindrical head and a slender, off-center shaft, the latter shaved and scraped to a sharp point. No attempt has been made to remove marks of the cutting tool on either end of the head.

Size. The lengths over-all run from 1 3/4 to 2 3/8 inches; length of heads, 3/4 to 7/8 of an inch; diameters of heads, 5/16 to 3/8 of an inch; diameter of shaft, 3/32 inch.

There is no decoration, and since the points are not polished by wear, as would be the case on an awl, they may have been used for fastening garments together. No such specimens have been noted from other places. Steamboat Cave, where 11 were found, contained both Pueblo and Basket-marker artifacts, but we are inclined to believe that the pins are of Basket-maker origin.

Hair Ornaments (fig. 143, *a–k*)

Source and Quantity. Upper Gila area—Doolittle Cave; Steamboat Cave; Mule Creek Cave. Hueco area—Ceremonial Cave; Picture Cave; Cave 6; Chavez Cave; Cave 4 (Buffalo Cave)—66 specimens, of which 50 are single prong, 13 double prong, 2 triple prong, 1 quadruple prong.

Material. Straight hardwood twigs, some so dense as to take a polish on pointed end; yucca-fiber cord, narrow strips of yucca leaf, cotton cord, and sinew to hold downy feathers.

Technique. The twigs are cut to length and the bark removed. One end has been whittled or scraped to a sharp point, then sanded and sometimes polished. At the upper end 1 to 3 bands of whipping hold the multiple prongs together. At times this whipping extends down the prongs for some distance, either in a wide or closely laid wrapping. The ends of the threads do not show as they are caught under the preceding turns. When these ends are tied together it is always with a square knot.

Size. The lengths vary from 4 3/4 to 12 inches (majority, 7 to 8 inches); thickness, 1/8 to 3/16 of an inch. One exceptionally heavy specimen measures 1/4 of an inch in diameter.

Decoration. With 1 exception, where the cord holding the feathers is dyed red, the decoration consists entirely of feather attachments, usually near the upper end but in some instances fastened continuously down the slender needle-like rod for half its length. These feathers are held in

place in 4 ways: (1) the quills are bound against the rod, as in figure 143, *a*; (2) the feathers are tied in series along a cord by 2 wraps of sinew around the quill, then a half hitch around the cord, after which the cord is wound around the rod, as at *e;* (3) encircling the rod is a strand to which short lengths of cord are fastened by a full hitch making a fringe, and a feather is then fastened to each fringe end by a whipping of sinew around it and the quill, as at *f;* (4) feathers are tied to the ends of short pieces of cord bound to the rod with sinew, as at *b* and *c*.

Fifty-nine hair ornaments in the collection came from the Huecos, which includes Cave 4 (Buffalo Cave) in the extreme southwestern part of New Mexico, while only 7 specimens are from the Upper Gila. At White Dog Cave in northeastern Arizona, Guernsey and Kidder found hair ornaments made of both slender bone and wooden pins. They also mention a hair ornament from Grand Gulch, Utah.[38] Our finds were distributed for some distance along the international line and well into the Upper Gila, where evidences of Basket-maker are less abundant. At present we have no information as to their discovery between the San Juan and Upper Gila or in the Big Bend area of Texas. Farther south, in the state of Coahuila, Mexico, 1 specimen, from Acateta Burial Cave, is cited by Guernsey and Kidder. Judging from the number of specimens now on record, hair ornaments seem to have been rarer in the north than in the Hueco area from which, in addition to ours, a number have been recovered by private collectors. Roberts also found some attached to pahos in the Hueco Mountains.[39]

For feather ornaments, see page 129.

Beads (figs. 144–46)

Source and Quantity. Upper Gila area—Doolittle Cave; Steamboat Cave; Mule Creek Cave. Hueco area—Chavez Cave; Cave 8; Ceremonial Cave—many specimens of different varieties.

Materials. White beads, shell, and gypsum, some of the latter translucent; black, probably beidellite; turquoise; *Olivella;* pink *Spondylus* shell; bone; seeds; sections of reed.

Technique. The bores of small, discoidal beads are usually cylindrical, those of thick specimens slightly biconical from having been drilled from opposite sides. The tubular bone beads, two of which are from a large bird ulna, were sawed, then broken, and little attention was given to smoothing the ends.

Size. The white, discoidal, shell beads (fig. 146, *a*) range from 5/32 to 7/32 of an inch in diameter; white stone beads from the Upper Gila, 1/8 to 7/32 of an inch; white stone beads from the Huecos, 9/64 to 63/64 of an inch in diameter, with thicknesses of 3/64 to 35/64 (*h*); black beads, 5/64 to 7/32 of an inch in diameter; turquoise, 5/32 to 13/64 of an inch; 1 tubular bone bead, 1/4 of an inch long; 4 larger specimens, 1 3/8, 1 5/8, 2 1/4, and 5 1/8 inches long (fig. 146, *i–l*).

Shell beads on the original strings are shown in figure 144, *a* and *c* (from Chavez Cave). In figure 144, *a*, they are strung on a white hair cord which has been dyed blue. The cord (*c*) is tightly twisted yucca fiber. The rough beads (*b*) are part of a necklace (Alves collection) from Ceremonial Cave; they are drilled plates of translucent gypsum, which were originally so threaded on 2 twined strands of yucca-fiber cord as to lie flat. The reed beads (*d*), from Chavez Cave in the Hueco area, strung on a yucca-fiber cord, are 1/2 an inch to 5/8 of an inch long and 3/16 to 5/16 of an inch in diameter. The charred ends show that the reed was sectioned by burning with a glowing ember. Coffin mentions beads made from pieces of reed from Bee Cave in the Big Bend of Texas. However, the strand illustrated by Coffin shows that the reed, possibly cane, was severed by being cut and the ends smoothed; they are less crude than those from Chavez Cave, which are too thin walled to permit of this process.[40] The necklace (*e*) is of large seeds strung on yucca-fiber cord. The seeds do not seem to be the same variety as those shown in a strand from Bee Cave, but this necklace illustrates a like adaptation of available material for ornamental purposes.[41]

In figure 145 are white and black stone, and occasional shell and turquoise beads, strung on soft cotton cords by which these ornaments originally were attached to pahos. All these are from Upper Gila caves. The use of loose-twisted soft cotton fiber, as in *d*, explains how it was possible to string beads with very minute perforations.

The series in figure 146, *h* illustrates the range

[38] Guernsey and Kidder, 1921, pl. 18, *a–c;* p. 51 and footnote.

[39] Roberts, 1929, pl. 3; fig. 7.

[40] Coffin, 1932, p. 57, fig. 16.

[41] Coffin, 1932, fig. 16.

in size of white stone beads from Ceremonial Cave. The extremely large ones are unusual, and because of their provenience are doubtless a product of the Hueco Basket-makers. The hemispherical bead (*e*), 7/16 of an inch in diameter with a bore of 15/64 of an inch, is from Doolittle Cave in the Upper Gila area. Although it does not have the biconical bore of those found with Basket-maker burials of northern Arizona by Kidder and Guernsey, yet, this 1 feature apart, its likeness to them suggests that it is also of Basket-maker manufacture.[42]

Few if any turquoise beads have come from the Hueco Caves. The series in figure 146, *b*, rubbed fragments of turquoise matrix, and a turquoise encrusted basketry armband from Ceremonial Cave (now in the Alves collection) are the only known instances in which this material made its way into the Hueco area.

Olivella shell beads (fig. 146, *f*) were comparatively rare. A few were found at 3 sites in the Upper Gila and at 2 in the Huecos, one of these being Ceremonial Cave where the Alveses gathered 96. In their collection from Ceremonial Cave are also several *Vermetus* shell beads, of which we have no specimens. Distance from the source of supply, as with the turquoise, probably accounts for the complete absence of black beidellite discoidal beads in the Huecos.

It has been mentioned that all paho wrappings upon which beads were threaded came from the Upper Gila. Although strings were tied to prayer-sticks in the Hueco area, no beads were attached to them.

Pendants (figs. 146,147). From the Hueco area are a series from Ceremonial Cave (fig. 146, *g*)—gypsum pendants 3/16 to 13/16 of an inch in length—another from Ceremonial Cave (fig. 147, *c*, *g*, *h*), and 1 from Chavez Cave (*b*). From the Upper Gila area are 2 from Mule Creek Cave (*a*, *d*), from Lone Mountain Cave (*e*), 1 from Doolittle Cave (*f*), and 1 from Cave 2, West Fork (*i*).

The pendant (fig. 147, *a*), a perforated ring of thin translucent shell still retaining its luster, is 1 1/16 inches in diameter. The pendants (*b* and *c*), having parts of the original yucca-fiber cords attached to them, are plates or opercular bones, covering fish gills. Figure 147, *d* is a fragment of shell bracelet with a strand of sinew thread through the drilled hole in one end. The pendant at *f*, a fluted piece of shell, seems to be a bird form with one of the wings broken away; *g* and *h* are mussel shells, bright as ever after lying so long in cave refuse; figure 147, *g* is 3 3/16 inches long and *h*, 1 1/2 inches in length. The pendant or gorget (*i*) depending on how it is suspended, is of pink *Spondylus* shell, 3 inches long. *Spondylus* was found in the Huecos and this specimen from the West Fork and a large discoidal bead (fig. 146, *d*) from Mule Creek Cave are the only ones from Caves in the Upper Gila. However, open sites in the latter area have produced numbers of small pendants made from this shell.[43]

A number of large and small abalone shell pendants (Alves collection) came from Ceremonial Cave as did 2 heads of 3-pronged wooden combs incrusted with an abalone mosaic. These and the *Olivella* beads prove trade relations through Arizona and California to the Pacific Coast. Although *Olivella* shells appear in Upper Gila sites containing both Basket-maker and Pueblo artifacts, only an occasional trinket made of abalone has been noted from that area. The few turquoise pendants from caves in the Upper Gila (fig. 145, *d*) are 19/64 to 25/64 of an inch in length. These are assigned to the Pueblo period, since they have been attached to pahos of that phase.

Bracelets (fig. 147, *e*). Fragments and 1 complete *Glycimeris* shell bracelet were found in the Upper Gila area at Doolittle Cave, Lone Mountain Cave, Mule Creek Cave, and Kelly Cave, and in the Hueco area, at Cave 2, Playas district. The complete bracelet (fig. 147, *e*), 2 3/4 inches in diameter, does not differ from those common to the general area.

GAMING OBJECTS

Cylindrical Gaming Sticks or Counters (fig. 148, *a–i*, *l–q*)

Source and Quantity. Upper Gila area—Cave 2, West Fork; Cave 1, Middle Fork; Steamboat Cave; Kelly Cave. Hueco area—Chavez Cave; Ceremonial Cave. Total from both areas, 139 specimens.

Materials. Majority of smaller counters, softwood with pith center; large specimens cut from yucca bloom stalk; ocatillo, or oak; decorated in green, yellow, brown, white, and black pigment.

[42] Kidder and Guernsey, 1919, fig. 76, p. 163.

[43] Cosgrove, 1932, p. 64.

Technique. The twigs or larger branches have been partly sawed or chopped through with a sharp stone implement and then broken into sections. The bark has been left on some and shaved or scraped from others. No attention was given to smoothing the ends of the cylinders, some of which had broken off at right angles, while on others the ends are tapered and show marks of a cutting tool.

Size. In the unpainted rough specimens the lengths vary from 1 3/8 to 6 inches; diameters, 1/4 of an inch to 1 inch. In a lot of 94 cylinders from Steamboat Cave, 89 range from 13/16 of an inch to 1 7/8 inches long and 5/32 to 5/16 of an inch in diameter; the remaining 5 are 2 5/16 to 4 1/2 inches long, and 5/16 to 3/8 of an inch in diameter.

Decoration. Of the painted sticks from Steamboat Cave (some shown in figure 148, *a–i*), 24 of these are colored all over with green, 17 with black, 16 with brown, 1 with white, 1 with yellow; 1 is striped lengthwise one-third yellow and the rest white; 1 is striped lengthwise one-third yellow and the rest black; 13 have brownish streaks caused by the bark not having been entirely removed; and 21 have bark entirely removed leaving them a light natural color. The only decoration or marking on the remaining unpainted sticks from this and other sites consists of lightly incised lines encircling the end of 4 small ones (*n* and *o*) and a spiral incising running the full length of another (*p*). One of the large cylinders (*l*), 5 inches long and 3/4 of an inch in diameter, has been diagonally scored over its entire surface with a sharp instrument.

The collection of 94 symmetrically made cylinders was cached among the fallen rocks in a dark corner of Steamboat Cave. Here were other offerings: sets of ceremonial bows, pieces of *tablitas*, split-stick wands, and crescent-shaped objects. The cylinders are probably not a complete set, because some may well have been overlooked in the mass of fallen roof stone. However, the wide variety of color shows that they were probably counters in some kind of game. Five are somewhat longer and may have had a different value. Whether they are miniature replicas of full-sized gaming sticks is not known because none of the larger cylinders found in this cave or at other sites were painted.

Among the miscellaneous large and small unpainted gaming sticks in the collection, only 6 are distinguished by a semblance of decoration or marks of incising. Most of the large ones are crude and rough and do not compare well with the large, smooth gaming sticks of the modern Pueblo or the short, square-ended, and thick cylindrical sticks used in Hopi games, but are like the "kicking billets" from cliff dwellings in Mancos Canyon.[44] Nearly all the heavy, rough, cylindrical sections of hardwood, like figure 148, *l* and *m*, came from the Hueco area. They may tentatively be classed as kick sticks, but it is probable that the small light counters found on the Upper Gila represent a less strenuous indoor game.

Kidder and Guernsey record small, plain, solid wooden cylinders from northeastern Arizona;[45] Morris found short, solid, wooden cylinders at Aztec Ruin in northern New Mexico,[46] and Hough shows short cylindrical blocks from Tularosa Cave (San Francisco drainage).[47] Coffin found a number of the more slender variety at Bee Cave, Brewster County, Texas, among them 8 smoothed unpainted sticks, 1 3/4 to 5 inches long and 1/4 of an inch in diameter.[48]

In Cave 1, Goat Basin, in the San Francisco drainage, we found a tubular cylinder, 3 1/4 inches long and 3/4 of an inch in diameter. Morris reports a painted tubular cylinder of this kind from Aztec Ruin. Whether these are parts of gaming sets is not known.

Bone Dice (fig. 148, *j*, *k*). These are from Doolittle Cave in the Upper Gila area and are made from sections of deer ribs. The single bone (*j*) is 11/16 of an inch long by 1/2 an inch wide; and the pair (*k*), bound together with yucca cord, measures 3/4 of an inch long by 5/8 of an inch wide. Two other such specimens were found at the near-by Swarts Ruin.[49] All these may possibly be counters.

Gaming Hoops and Ring (fig. 111, *a–d*)

Source and Quantity. Upper Gila area—Doolittle Cave; Steamboat Cave—9 hoops and 1 ring.

Materials. Small slender twigs; yucca, cotton, and sinew for tying.

[44] Culin, 1907, figs. 884, 885, p. 667.

[45] Kidder and Guernsey, 1919, p. 186; pl. 84, nos. 25–27.

[46] Morris, 1928, p. 45.

[47] Hough, 1914, figs. 134, 135.

[48] Coffin, 1932, p. 27; also personal information.

[49] Cosgrove, 1932, p. 62, fig. 11, *e*.

Technique. The bark has been scraped off the twigs, bent into a circle with the ends tied together. The over-lapping ends, which have been either left round or flattened (fig. 111, *a*, *c*) are bound together with whippings of single-strand cotton or 2-strand yucca cord. The ends of *c* are held by a whipping of sinew.

Apparently at one time figure 111, *a* was entirely covered with wrappings of yucca-fiber cord, while *b* has irregularly spaced double wrappings which still hold sections of a continuous cord that originally encircled the hoop. All cords are of the same size.

Size. The small series vary from 2 1/4 to 3 inches in diameter, and the larger hoops from 3 3/4 to 7 inches in diameter; twigs, 1/8 to 3/16 of an inch thick.

The ring (fig. 111, *d*) in the collection is a disc of bark which has a 5/8 inch hole bored through it.

Hough illustrates small hoops similar to these from Tularosa Cave.[50]

The small, light specimens just described are called gaming hoops, since there is nothing to show that they were rims for basketry trays or containers.

[50] Hough, 1914, pl. 12, nos. 3–6.

PICTOGRAPHS AND PETROGLYPHS

IN ROCK shelters and caves, many pictographs were seen under the protective overhangs; in the open, on boulders and rimrocks, petroglyphs were found. Whirling sand and age have all but obliterated great numbers of the painted figures and those pecked in stone. Figures 50, 52, 56, 44, 45, 46, and 47 illustrate a few that were observed in the Hueco and Upper Gila areas.

At present little can be said as to the significance of these figures. Some appear to be as nearly naturalistic as the artists could render them. Human figures and masks may represent deities or priests and ceremonial paraphernalia. Figure 44, showing pictographs from Picture Cave in the Playas district, has, among plumed or horned serpents (nos. 21–24), a realistic rattlesnake (no. 20). The conception of the plumed serpent was, of course, widespread in prehistoric Mexico and representations of this mythical creature are found on ancient Hopi pottery, but there is little evidence of the cult in the Mimbres and Upper Gila, lying between Casas Grandes and the Hopi country. The only instances known to us are the paintings of such a being in the shelter in the Huecos and 2 reported by Fewkes on Mimbres bowls from graves at a site 12 miles south of Deming, New Mexico, and about 25 miles north of the international line.[1] Thus the worship of the plumed serpent seems, in our region, to have been confined to the southern periphery. Some Mimbres bowls, however, bear composite human-animal figures with rattlesnake tails.[2]

Figure 45 shows masks with horns, or terraced *tablitas*. On figure 46 are drawings of pictographs from caves in extreme southwestern New Mexico. There is a possible map showing trails, also reptiles, the ubiquitous three-legged man, animal tracks, and geometric designs. Such motifs are prevalent not only along the Mexican border but also in the Upper Gila. Of particular interest is no. 7 (fig. 46, *c*), a painting 8 feet long, easily recognized as that of a buffalo. Its date is unknown. It may have been made by a hunter who had seen these animals farther east, or it may indicate that buffalo occasionally crossed the Rio Grande and grazed as far west as the New Mexico-Arizona line. In figure 47 are pictographs and petroglyphs from the Mimbres Valley north to the San Francisco and the headwaters of the Gila. The animal at *b* is painted on the wall of a cliff-ruin room, Middle Fork of the Gila (fig. 56, *b*). In figure 47, *g* are some petroglyphs on a cliff in the Mimbres Valley, the grouping of which may be seen in figure 50, *b*. An example of deep channeling in floors of caves, which some people have interpreted as maps, occurs in a cave near the Mimbres Valley and another is shown in figure 52, *b*, cut into the white chalky floor of a pocket adjacent to Saddle Mountain Cliff Ruin on Pueblo Creek, a tributary of the San Francisco. In addition to the waved channels, there are incised human foot prints, bear and turkey tracks, and oval depressions apparently worn by the sharpening of stone implements.

No painted hands were seen in the Hueco area, although these occur in the Upper Gila as outlines, stencils, and prints, in yellow, black, and red (but not in white as in northern Arizona). The large square-shouldered Basket-maker figure, so common in the San Juan country, is also absent.

The following is a list of sites at which pictographs and petroglyphs were observed.

Figure 44 and 45, pictographs in red from Picture Cave, Hueco area of west Texas.

Figure 46, pictographs and petroglyphs in extreme southwestern New Mexico: *a*, pictographs in Cave 5, Picture Cave, Alamo Hueco Mountains: no. 1, teeth alternate red and white; no. 2, red and white zigzag lines, red line above white line; no. 4, white sun (?) outlined with red and with rays painted alternately red and white; all other figures red.

b, petroglyph on Animas Mountain.

c, pictographs in Cave 4, Buffalo Cave, east side of Alamo Hueco Mountains: nos. 2, 4, 5, and 7, black; all other figures red.

d, red pictograph in cave on west side of Alamo Hueco Mountains.

Figure 47, pictographs and petroglyphs in New Mexico. *a*, red pictograph in Cave 5, Sipe Canyon, San Francisco drainage.

b, black pictograph in Cliff Ruin 2, Middle Fork of the Gila.

c, pictographs in cave near G O S Ranch,

[1] Fewkes, 1914, p. 43; fig. 28. Fewkes, 1923, p. 33.

[2] Cosgrove, 1932, pl. 230, *e*.

FIG. 44. Pictographs, Picture Cave, Playas district. (For color scheme and more accurate location, see p. 155.) Drawings not to scale.

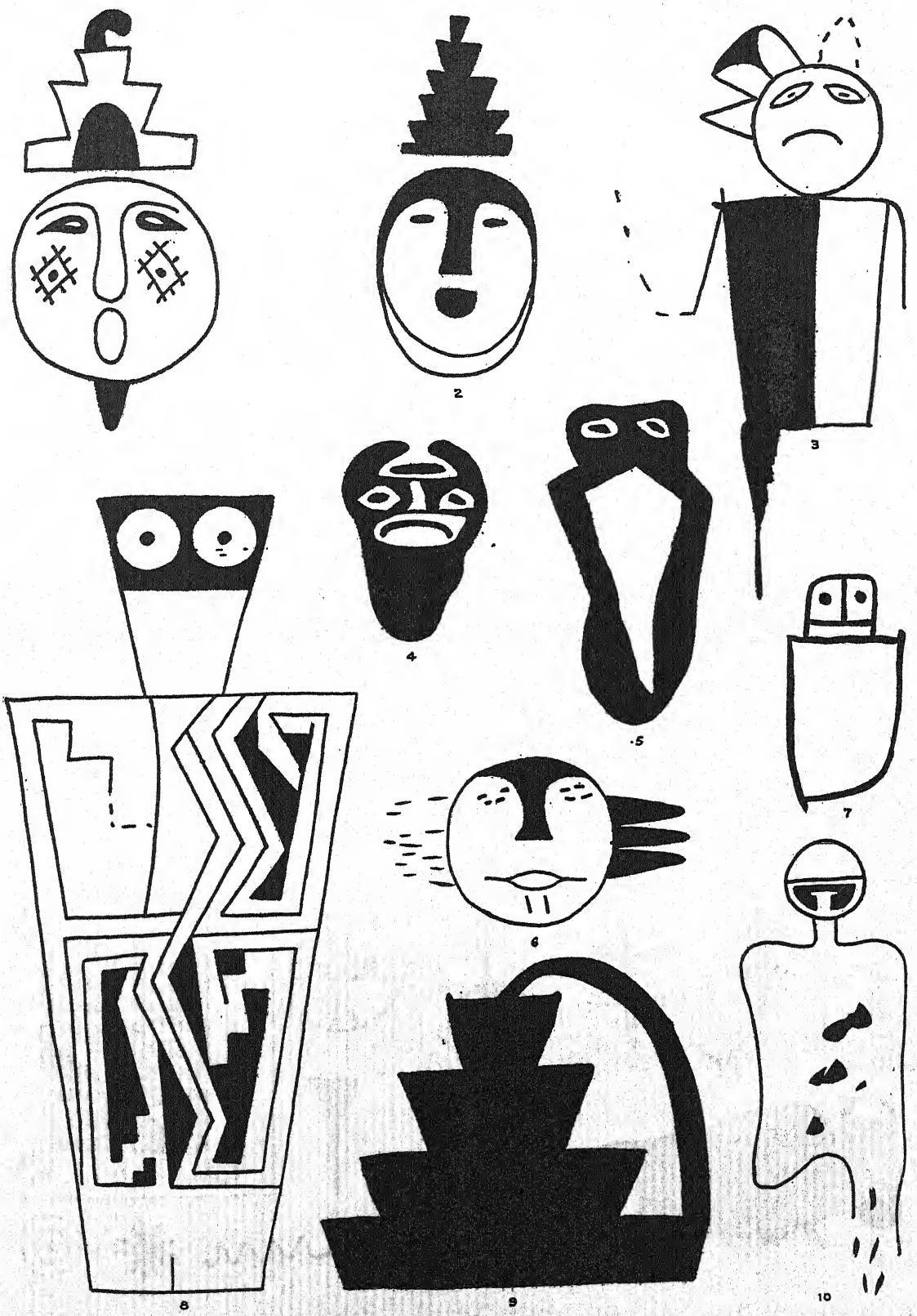


FIG. 45. Pictographs, Picture Cave. Playas district. (For color scheme and more accurate location, see p. 155.) Drawings not to scale.

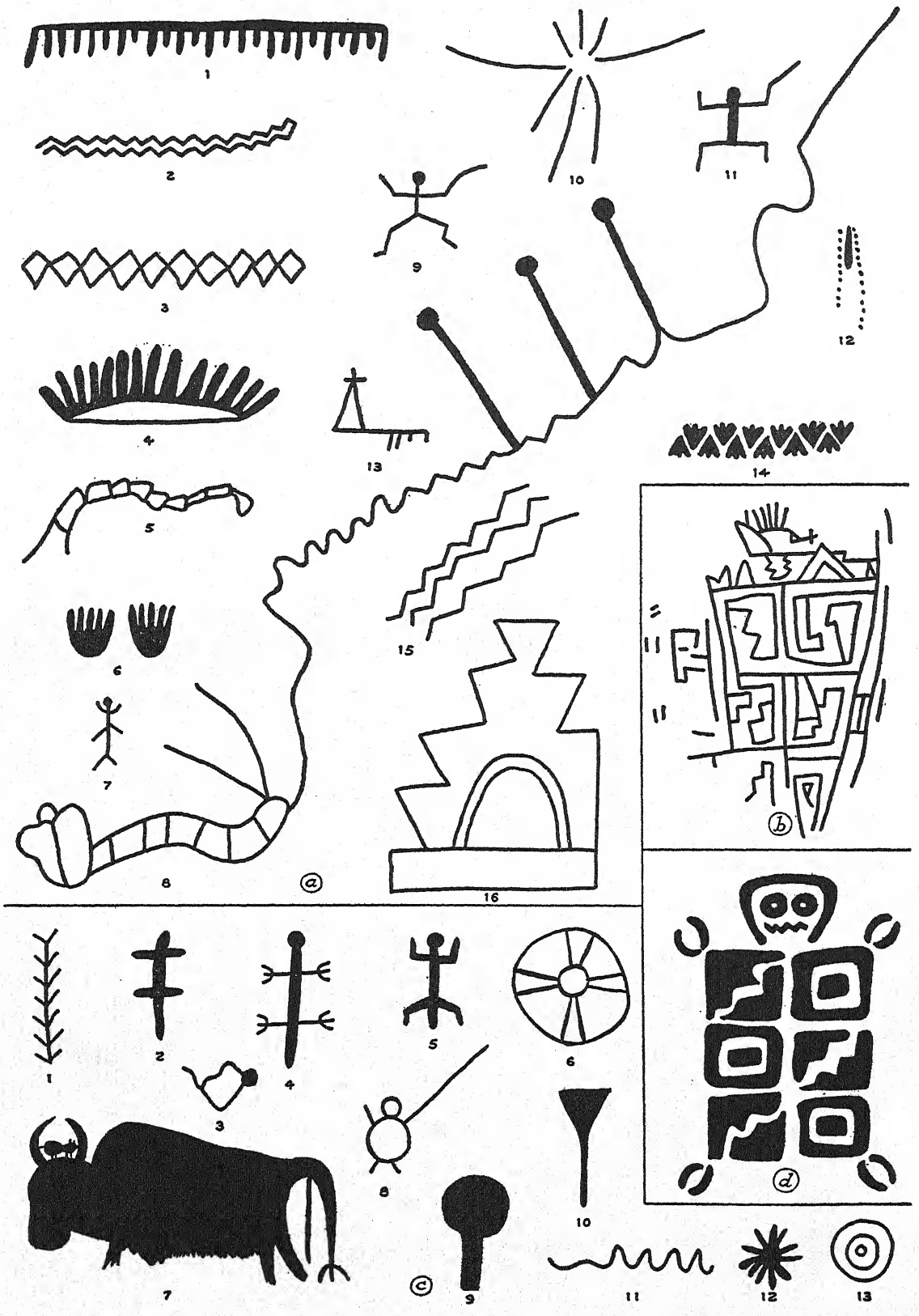


FIG. 46. Pictographs and petroglyphs, Playas district. *a*, Cave 5, Picture Cave; *b*, Animas Mountains; *c*, Cave 4, Buffalo Cave; *d*, cave on west side of Alamo, Hueco Mountains. (For color scheme and more accurate location, see pp. 155, 160.) Drawings not to scale.

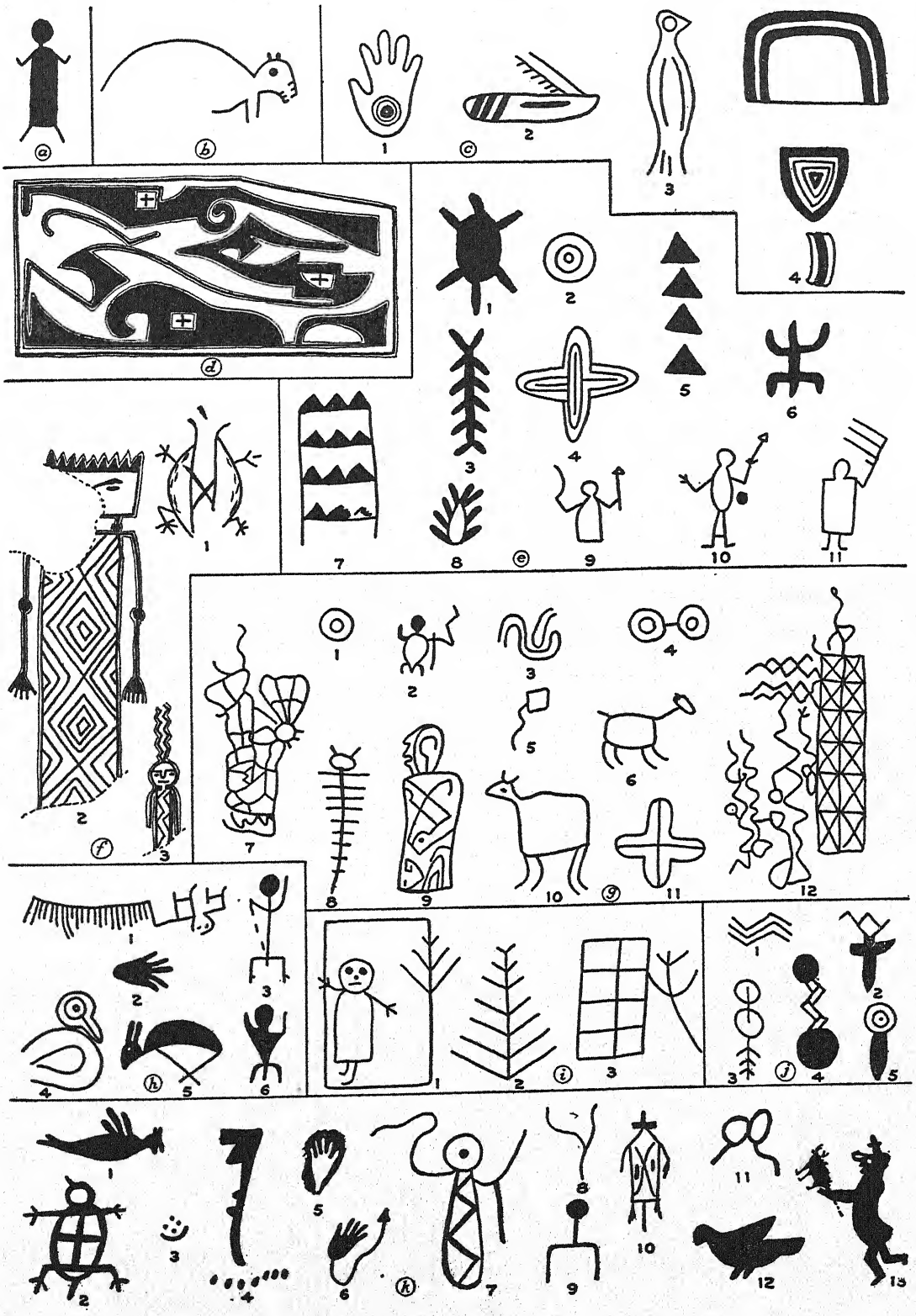


FIG. 47. Pictographs and petroglyphs. Upper Gila and Rio Grande areas. (For color scheme and more accurate location, see pp. 155, 160.) Drawings not to scale.

Sapillo Creek, tributary to the Gila: no. 1, yellow hand outlined by red, yellow dot in palm surrounded by concentric circles of red, green, and white; no. 2, body of winged object outlined in red and marked with green, wing red and green line fringed with ticks of alternate red and green; no. 3, bird done in red; no. 4, upper unit yellow outlined in red, green, red; shield-shaped unit, yellow center outlined red, green, white, green, red; lower unit green, red, yellow.

d, pictograph in cave in Sycamore Canyon, 14 miles north of Silver City: design framed with green and red lines, red figures of design outlined in green.

e, red pictographs on rocks, south side of Silver City.

f, pictographs in west side of Mimbres Valley on rimrocks of Table Top Mountain: no. 1, black; nos. 2 and 3, red outlined in black.

g, petroglyphs in west side of Mimbres Valley near Rock House Ruin, east of Faywood Hot Springs.

h, pictographs in Dootlittle Cave and petroglyphs 4 miles west of Doolittle Cave, Mimbres Valley; nos. 1 and 4, pictographs in red, yellow, and black; all others petroglyphs.

i, petroglyphs near San Juan, Mimbres Valley.

j, petroglyphs near Tonuco, Rio Grande Valley.

k, pictographs in Sandal Cave, Nogal Canyon, 15 miles southwest of San Marcial: nos. 1, 3, 4, 8, 9, 10, and the dot in 7, yellow; rest black. (At this site there were 5 stenciled hands in yellow and 6 daubed hand marks in yellow.)

BURIALS

Source and Quantity. Upper Gila area—2 infants, 1 adult. Hueco area—2 infants, 3 adults.

Upper Gila Area. Two fragments of infant's femurs were found in the refuse at Doolittle Cave. At Cliff Ruin 3, Middle Fork of the Gila, an infant burial was found, 2 feet below the surface against the back wall of the room. The body was covered with a large, plain olla sherd, "killed" by a hole broken through it.

In Cave 2, West Fork of the Gila, adjacent to the Gila Cliff Dwellings National Monument, a disturbed burial was found in rubbish, behind a large boulder, resting on a narrow shelf against the back wall at the head of a steep downward-sloping floor. The bones and skull, showing artificial occipital flattening, were those of a male not over 25 years of age.

Hueco Area. Near the front of Chavez Cave was found the patello of an adult. It was learned that 25 or 30 years previous to this the desiccated body of an Indian pierced with an arrow was taken from the front of the cave, and it is probable that the patella was from this late burial. At Ceremonial Cave parts of the skull and lower jaw of an infant 28 to 32 months old came from the refuse, also several vertebrae and a fibula of an adult. The original grave of the adult was located in the fill lying on a hard-packed stratum in a bay on the south side of the cave (fig. 63, *b*). The skeleton was incomplete and probably had been pulled about by animals, but enough bones remained in place to show that the body had rested on its back with the head to the south. Near the skull were fragments of a seed necklace (fig. 144, *e*), a mussel shell pendant (fig. 147, *g*), and 3 small basketry discs (2 shown in figure 100, *b*, *c*). In the pelvic cavity was a stone projectile point and another at the right side of the body (fig. 131, *a*, *f*). Lying among the bones was a worn fish-tail sandal (Type 5*b*) and a pad of yucca fiber containing 2 pieces of a wide woven band (fig. 84, *d*). The body, that of a woman 21 to 35 years of age, had been wrapped in a fur-cloth blanket as shown by fragments of stripped rabbit hide (not wrapped around a cord). The skull, which has some short hair clinging to it, is undeformed, mesocephalic (fig. 149, *a*). Dr. George Woodbury furnishes the following measurements:

Cranial Index 79.5 (mesocephalic)
Length by Height Index 70.7 (orthocephalic or medium height)
Nasal Index 47.8 (mesorrhine or medium)
Upper Facial Index 51.2 (mesene or medium)
Stature 155.2 cm. (short)

In Cave 1 a very young infant was buried at the head of an adult in a shallow grave near the front of the cave and against the north wall (fig. 64, *a*, *b*). The refuse in the cave was not over 2 feet in depth, and it is surprising that these burials, which rested on the rock floor with a thick protective layer of soft grass and a foot of dirt over them, had not been more disturbed. Both bodies were wrapped in fur-cloth blankets, the fur strips of which were twisted on themselves and not wrapped around a cord (p. 66). The part of the blanket lying below the adult body was fairly well preserved, while little fur remained on the twisted hide strands above. One tibia of the adult was missing, probably dragged away by animals. Nothing was found in the fur-cloth blanket around the infant. The adult lay on the right side in a closely flexed position, with hands at the right of the skull. A coiled basket (fig. 96, *b*), coated with meal on the inside, was inverted over a padding of grass which covered the skull. The type of this basket is that with rod-surrounded-by-bundle foundation and wood-splint sewing element. A small basket (fig. 96, *a*), with 2-rod-and-bundle triangular foundation and wood-splint sewing element, was inverted over the center of the body. At the right of the skull and over the right hand was inverted a squarish-shaped checkerweave basket of sotol leaves (fig. 101, *a*). Inside this was a small pear-shaped buckskin pouch (fig. 127, *e*), filled with a powdered substance resembling cornmeal. An associated object which brings to mind a throwing dart is a slender 35-inch unpeeled hardwood branch, 5/16 of an inch in diameter at 1 end and 1/2 an inch at the other, which rested on the square sotol basket and on the knees and feet of the skeleton. The branch is cut off squarely at the small end, and 3 inches from it an inch-wide whipping of sinew holds the tips of 2 9-inch feathers, the heavy

ends of which are fastened to the shaft with a wrapping of split yucca leaves. Between the legs of the skeleton was a pad made from the soft inner fiber of the thick-leaved agave plant. Outside the large fur blanket enclosing these objects was a bundle of herbs (*Artemisia ludoviciana*), and in the matted grass over the pelvis was a Type 5*f* fish-tail sandal. The clothing thus consisted of a fur-cloth blanket and a crude loin cloth. The sandal, though not attached to the foot, is typical of the region. Some tissue and short-cropped coarse gray hair still adheres to the skull. The teeth are badly worn; most of those in the upper jaw and some of the molars in the mandible are missing, with alveolar margins resorbed, denoting a person past middle age, 56 to 75 years. The body is that of a male with undeformed, mesocephalic skull (fig. 149, *b*). Dr. Woodbury again gives us necessary measurements:

Cranial Index 77.9 (mesocephalic)
Length by height Index 75.7 (hypsicephalic or high vaulted)
Nasal Index 51.0 (chamaerrhine or broad)
Upper Facial Index 46.0 (eurene or broad)
Stature 166.1 cm. (middle)

Among the 8 burials, or evidences of such, three from the Upper Gila and one from Chavez Cave in the Hueco area are Pueblo; the infant and 2 adults from Cave 1 and Ceremonial Cave in the Hueco Mountains are certainly Basket-maker. This conclusion is based both on the undeformed mesocephalic skulls of the adults; and on the grave furnishings, such as an early type of fur-cloth blanket, coiled baskets, a leather pouch containing meal, and what at first might be considered a prayer-stick but in reality appears to be a crude representation of a feathered dart. In addition, attention is called to the atlatls, darts, grooved fending sticks, tree-shell trowels, hair ornaments, and twined-woven bag fragments from the same sites, all of which are characteristic Basket-maker products.

Southeast of the Huecos, at Burnet Cave on the eastern slopes of the Guadalupe Mountains, Howard unearthed 5 burials, four of which were cremations.[1] The importance of this discovery justifies the listing of furniture in each grave.

Burial 1. Decayed bones in a large tray basket with a second over it (one with design in triangles); both baskets of the two-rod-and-bundle triangular technique sewed with wooden splints.

Burial 2. Cremation; bones, seed beads, pieces of antelope and buffalo hide, and headdress of golden eagle feathers all in large decorated twined-woven bag which had been split part way down the side.

Burial 3. Cremation; fragments of twined-woven bag, 2 shell bangles, "bits of grass basket"; skull, after mending "seems dolicocephalic."

Burial 4. Cremation; "very fragile bits of some sort of grass basket."

Burial 5. Cremation; covered with sticks and tule; bones in fragments of bag placed in 2 wooden splint sewed coiled baskets of two-rod-and-bundle triangular technique; baskets " probably covered by another basket that came to light somewhat farther to the west." In one of the baskets was found the spur end and several other pieces of an atlatl, partly adhering to the side of the basket. Likewise there was a pinkish quartz pebble with a distinct band about the middle as though it may have been used in connection with the atlatl.

In the same neighborhood a native told Howard of a cremation found with coiled baskets, one containing the charred bones.[2] Near the mouth of the Pecos River, at Moorehead Cave and Goat Cave, Setzler recovered desiccated bodies and cremations wrapped in matting. One grave was furnished with baskets and a fur robe as well as mats. Some also contained "fragments of milling stones."[3]

At the Shumla Caves, also near the junction of the Pecos and Rio Grande, Martin discovered parts of atlatls and darts as well as a number of graves, one or two being cremations. Some bodies were covered only with mats, others with fur cloth and furnished with baskets. Nearly all contained manos and metates. The skulls were long and undeformed.[4]

Burials found by Pearce and Jackson in caves along Seminole Canyon in the neighborhood of the Shumla Caves contained numbers of metates and manos but few remains of matting and no fur cloth or baskets.[5] Measurements by S. J. Thomas show that the skulls were long and undeformed.[6]

[1] Howard, 1935, pp. 67–69.
[2] Howard, 1932a, pp. 7–19.
[3] Setzler, 1934, pp. 35–37.
[4] Martin, 1933b, pl. XL, pp. 19–24.
[5] Pearce and Jackson, 1933, pp. 56–71.
[6] Pearce and Jackson, 1933, p. 71.

Farther south and west in the Big Bend country, Harrington tells of a burial in Bee Cave accompanied by a coiled basket.[7]

It is to be noted that as we leave the Hueco area and travel down the Pecos River there occurs a change in burial customs. Cremations appear; plaited and threaded rush mats are used extensively as covers, sometimes omitting the fur-cloth blanket; often no baskets are found in the graves. Then too, at the Setzler, Martin, and Pearce sites numbers of mealing stones accompanied the burials. However, the presence of long undeformed skulls, twined-woven bags, coiled baskets, fur cloth, and in one instance an atlatl in a basket accompanying an interment, to say nothing of previously mentioned Basket-maker artifacts in both the Hueco Basket-maker and Pecos Cave Dweller sites, seem substantial evidence for indicating a wide southeasterly extension of Basket-maker-like culture.

[7] Harrington, 1928b, p. 314.

CONCLUSIONS

ALTHOUGH we have made use of the Basket-maker–Pueblo time scheme as a general framework for this report, we have done so with 2 reservations. First, we have tried to guard against the tendency to make of this relative and generalized table an actual chronology. Second, it seemed to us that the division into Basket-maker II and III, amply justified in the San Juan, was not applicable to the area of the Hueco Basket-makers. Here, so far as is now known, there was no clearly defined development —no progression, for example, from crude, unfired pottery to a well-tempered, hardened product, nor from square-toed to scallop-toed sandals —but rather a lag in development similar to that noticed among the primitive people west of the Colorado River. Consequently there are no criteria by which to distinguish subdivisions within the general Basket-maker period.

Stratigraphically, deposits in the caves of the Upper Gila and Hueco areas (the 2 divisions of the Hueco Basket-maker range) were disappointing. No fire hearths were found; and though here and there levels were indicated by a layer of grass bedding (sometimes burned), superposition was never definite enough to permit relative dating of artifacts. In most instances the trash which had not been disturbed by previous digging was comparatively loose, solidified only in places by the excrement of rats. Deposits ranged from 6 to 36 inches in depth, with the maximum occurring in but 2 sites.

About all that can be said with regard to chronology in this region is that the older culture is probably not earlier than San Juan Basket-maker II. In the Pecos and Big Bend areas the scarcity of corn and the almost total lack of pottery might be taken as indications of a Basket-maker I horizon, but in these areas, also, similarity to the San Juan Basket-maker culture is so marked that a contemporaneous or subsequent date for the southern cave occupation seems more reasonable.

Should the term Basket-maker as now defined by reference to traits of early people in northern Arizona and southern Utah be applied to the pre-Pueblo cultures of southern New Mexico and western Texas? Authorities have not agreed on this point. Martin speaks of specimens from caves in the Big Bend region and at the mouth of the Pecos River as Basket-maker. On the other hand, Pearce and Jackson and Setzler, although recognizing certain similarities between artifacts of these regions and those of the San Juan Basket-maker, call the people of the southern area Cave Dwellers, and consider them wholly independent of the Basket-makers to the northwest. Sayles, in reporting the results of a survey in Texas, also uses the term Cave Dwellers and subdivides the territory into 3 overlapping areas: Pecos River, Big Bend, and Hueco.

On the basis of the comparisons embodied in this report, we are convinced that the early peoples of the Upper Gila and Hueco areas were affiliated, though possibly remotely, with the San Juan Basket-makers. This conclusion is supported by the tabulation presented in the table and by the distribution of sites (fig. 48) which yielded characteristic San Juan artifacts as well as southern variants. It is assumed that these sites either are Basket-maker or show the result of contact with the northern Basket-makers. In the tabulation, the Guadalupe Mountains, which extend for a short distance from New Mexico south into Texas, have been included in the territory of the Hueco Basket-makers because of the many striking similarities found in the traits of the 2 regions. Variations, such as cremation, which occur both in the Guadalupe Mountains and at the mouth of the Pecos, may have been the result either of local differences in environment or of the influx of a different ethnic group. As one goes from the Pecos and Big Bend into the Hueco area proper, similarity to the San Juan culture becomes more marked. This can best be demonstrated by the following summary comparison of various aspects of material culture.

Architecture. As seen in the comparative tabulation, there were grass-lined sleeping and storage pits and fiber-chinked slab cists in the Hueco and Big Bend areas, and in the Upper Gila were grass- and slab-lined storage pits, and also grass- and leaf-lined sleeping pits, some of the latter with stones piled around them for a windbreak. Also in the Upper Gila was 1 group of both storage and sleeping cists partially lined with

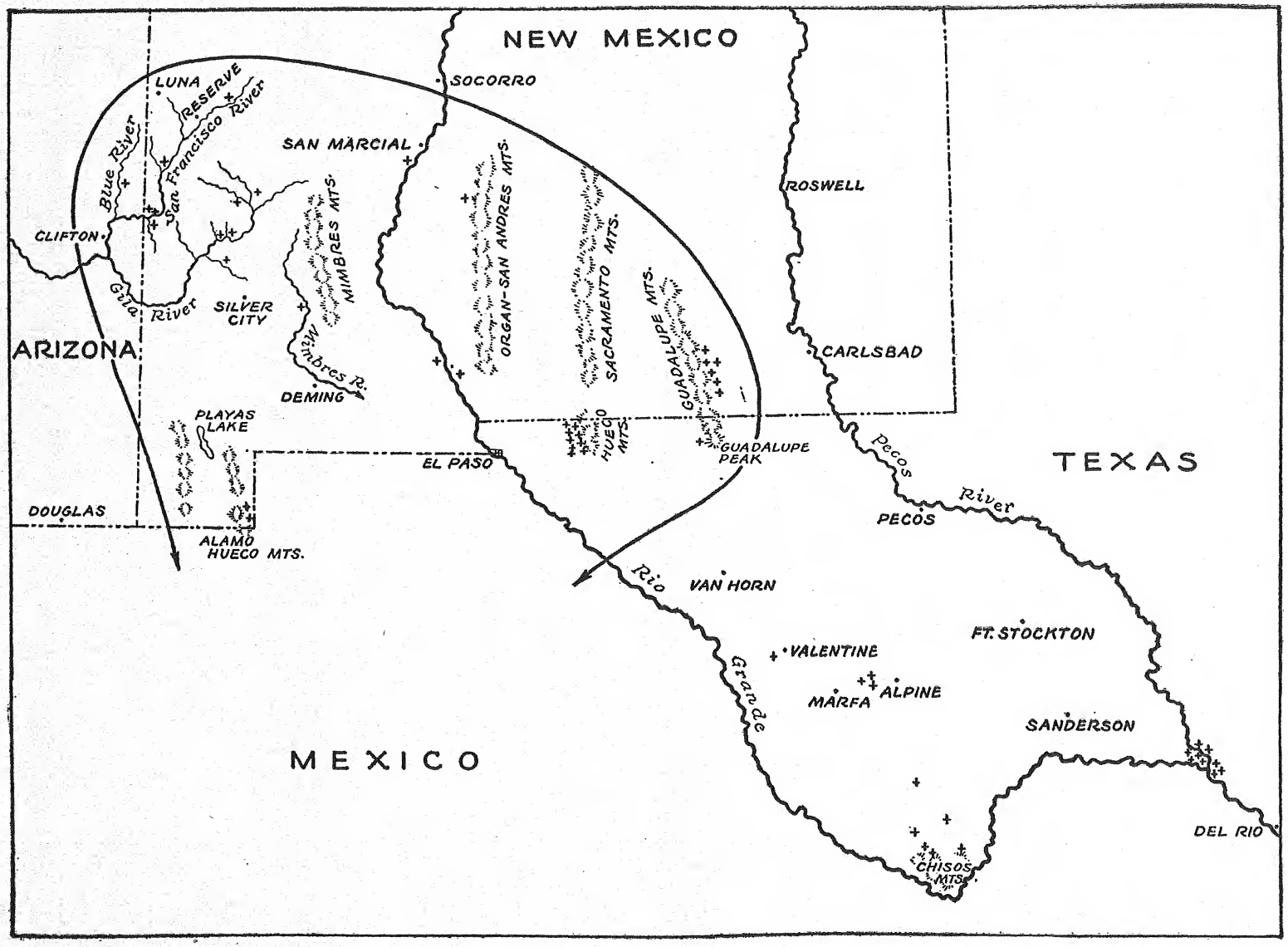


FIG. 48. Distribution of Basket-maker sites. Outline bounds the present-known Hueco Basket-maker area. Other sites that have produced like artifacts are indicated in the Big Bend-Pecos River areas of Texas.

stone slabs. These are strongly reminiscent of like features in the San Juan, but nothing appears in the Upper Gila and Hueco areas to show that a house type was developed from them. However, in the Big Bend the rough semicircular house foundations abutting the back wall of Bee Cave are faintly suggestive of such an evolution.

Circular pit houses were discovered by Bradfield at the Three Circle site and also at the Cameron Creek Village. Previous to this, at Treasure Hill, a site east of Silver City, we had found rectangular pit houses (then termed kiva-like rooms) with walls partly of rubble and with a floor-level opening to an outside ventilator shaft. Subsequently, when Bradfield was making like discoveries at Cameron Creek, we found at the Swarts Ruin an earlier form of roughly rectangular plastered pit house with rounded corners, but without the ventilator. This type had either a sloping entrance in 1 side opposite the fire pit, or an entrance through the roof. However, all these early houses in the Mimbres and Upper Gila yielded a finished pottery, and at present there is nothing to link such structures with the cave cits, of which the ones lined partly with slabs undoubtedly were constructed by Basket-makers. The same is true in the Hueco and Big Bend areas.

Both poor and exceptionally well-laid stone and caliche walls which had supported roof timbers were observed in the Pueblo cliff ruins of the Upper Gila, but in the Hueco and Big Bend areas, though suitable material was at hand, there was, with the exception of Bee Cave just mentioned, not the least evidence of masonry in any form. True masonry was also lacking in the Upper Gila caves containing Basket-maker remains, even though Pueblo artifacts were often found in them. The breastworks in 1 such site in this area (Steamboat Cave) cannot be classed as masonry, because their stone slabs were carelessly propped on edge without chinking or mortar.

Probably some of the rock shelters in the Upper Gila were used only as summer camps by people living in villages, but those in proximity to tillable land may have been occupied continuously. Numerous walled granaries in pockets in the rocks or adjacent to cliff ruins attest the Pueblo method of protecting their harvest from rodents.

In the Hueco area, although many caves were large and ideally located, none were permanent domiciles. They appear to have been used only as emergency shelters by hunters or hard-pressed transients.

Food. The early-developed variety of Flint corn was found generally over the southern area. Here, as in the north, it dates back to the beginning of Basket-maker II. Squash seeds and rinds were also found, but nothing can be said as to the antiquity of this item of diet because the specimens were not associated with Basket-maker artifacts. The same applies to the agave quids present in quantity in cave refuse and to the nuts and seeds which we found at different places.

Weapons. Atlatls, darts, and grooved fending sticks show up in all districts of the southern area. In the Hueco area, as in the San Juan, the bow and arrow probably made its appearance before the end of the Basket-maker period. This is suggested in the Hueco area by miniature duplications of wooden dart bunts, one of them set in a reed arrow shaft. The hinged-stick snare for capturing game was found in both the Upper Gila and the Hueco areas; the Hueco also furnished noose-cord snares much like those described by Guernsey and Kidder. With the exception of a set of fending sticks—sinew-wrapped and aberrant also in form, but having the characteristic grip-end bumper—which we consider one individual's variation of the grooved stick, all implements of hunting and war conform to the standardized Basket-maker types.

Cradles. As in the San Juan, crude, flexible, and semi-rigid cradles were used, and infants were wrapped in fur-string blankets. Flexible beargrass cradles somewhat similar to the cedar-bark ones of the San Juan and almost identical with some found by Cummings in a Basket-maker site of northeastern Arizona were taken from Steamboat and Kelly Caves in the Upper Gila (pp. 117–18). The boat-shaped cradle of twigs discovered by Setzler at Knight Cave in Presidio County, Texas, may be classed with this type. Verging on the closely woven, hard-backed cradle of the San Juan are 2 types found by Martin at Shumla Caves, near the mouth of the Pecos River in Texas. One is framed by a forked tree branch and filled longitudinally with wooden rods; two others have a V-shaped frame consisting of a pair of sticks tied together at 1 end and spaced throughout the rest of their length by crossbars of wood upon which a piece of matting was possibly laid. Nothing resembling the rigid umbilical pad of the north has come to light.

Textiles. The technique of weaving fur-cloth blankets in the southern area corresponds to that in the north, both in what is considered to be the earlier practice of making soft rolls by twisting together strips of fur-covered hide alone, and in the improved method of wrapping them around a fiber cord to produce a stronger fabric. The early type of San Juan Basket-maker feather cloth made from strips of bird pelts does not, as far as is known, appear in the south, and even among the Pueblo remains there were few examples of feather cloth in which the vane stripped from the quill was twined around cords, or downy feathers were held in place by twisted strands.

The specimens which we identify as yucca-string aprons correspond to the northern fringed type, but none of the coarse-bark loin cloths or woven human-hair aprons were found.

With colored yucca cords as their only material, the southern Basket-makers duplicated, though more coarsely, the twined weaving of the north and turned out work which, considering the material, is scarcely less deserving of credit than the astonishingly intricate cotton lace and weft-wrap openwork of the Pueblo weavers of the Upper Gila. They were equally proficient in the technique of coiled netting. In the Big Bend country, this type of weaving seems to have taken precedence over twining.

There was a general use of the coiled-netted technique in coarse carrying nets of stripped and loosely twisted yucca leaves, and of knotted-cord netting for bags and for game and fish nets—the small mesh in bags, the large in nets.

Bark for containers was not used in the south, and although human and animal hair entered into small amounts of cordage, it was not employed so extensively here as in the San Juan. Yucca, as everywhere, furnished the principal fiber.

In the manufacture of matting, both in the north and the south, tie twining was used to bind bundles of crushed, naturally soft material, but twined sewing for this purpose seems not to have been used in the south. Plaited matting, which has been taken as diagnostic of the Pueblo period, cannot be so considered in the Hueco-Big Bend, since the technique was practised in early times in the latter area.

Sandals. Among the sandals collected in the south, there is nothing comparable in form to the fiber and cloth square-toed or scallop-toed sandals of the San Juan Basket-makers, although the disparity is not quite so pronounced in the full-length crushed yucca-leaf sandals. In fact, as pointed out, 1 form from the Upper Gila (Type 14) is similar in weave to Basket-maker II footgear found in Marsh Pass, northern Arizona. If it were not that the toe sandals of 2, 3, and 4 warps (one known as the fish-tail) and also a roughly made 2-warp full-length sandal had been found with Basket-maker artifacts, they would have been considered foreign to that culture. The crude, stitched, full-length Big Bend sandal, which is comparable to the Coahuila type, and 1 example of a twilled toe sandal were also associated with atlatls, darts, and grooved fending sticks.

Basketry. Our opinions have been given in sufficient detail in discussion of coiled basketry (pp. 99–100) so that they need not be repeated here. Hueco coiled basketry is preponderantly non-Basket-maker. But the fact that two-rod-and-bundle uninterlocked specimens constitute about 20 per cent of the total seems to us a strong argument for relationship between the peoples of the Hueco and of the San Juan.

Figurines. In the southern area figurines might be classed among the missing were it not for several such unfired clay fetishes found by Coffin at Bee Cave in the Big Bend. Because they are plummet-shaped and decorated with paint, they do not have much resemblance, except as suggested by the nose, to the crude, flatter, clay objects shown by Guernsey from northern Arizona and by Morss from the supposedly peripheral Basket-maker sites of southern Utah. It may be that figurines were known to the southern Cave Dwellers in early times but were not generally adopted as cult objects, or these specimens may be of late origin.

Pottery. Among the culture traits which are present in the San Juan Basket-maker horizon but are absent in the south are unfired vegetable-tempered "pottery" of late Basket-maker II and the gray ware of Basket-maker III. Roberts thinks the southern culture was contemporaneous with Basket-maker III and that it had some form of pottery. We concur in the this opinion, but as yet we cannot agree with him about the presence of pottery, since in some caves there is no pottery and in others where it does occur it is always a surface find. Some of these surface sherds represent a nondescript rough- to smooth-finished ware with paste ranging from brown to gray which might be classed as early were it not so often (especially in the Hueco area) associated with

and apparently related to the El Paso Polychrome and the Chupadero Black-on-white Pueblo III pottery.

Ceremonial Objects. The list of ceremonial objects is varied. Some of them, although definitely Basket-maker, are entirely different from and foreign to the San Juan. Many of the offerings, as shown by association and by the descriptions which have been given, are Puebloan.

In the Upper Gila many caves were utilized as shrines by the Pueblo. Whether or not they were so used by the earlier peoples is not clearly indicated by the character of the Basket-maker artifacts in them. The quantity of offerings left in such places as Greenwood Cave, Mule Creek Cave, and Cave 1, Goat Basin, all in the Upper Gila area, shows that these were particularly sacred retreats visited numberless times by the Pueblo. The same is true of the Hueco Ceremonial Cave, which previously had been long used as a Basket-maker depository. Although Pueblo village ruins are present in the vicinity, few utilitarian Pueblo objects were found in the Hueco caves. Hence, it seems that the Basket-maker artifacts and offerings to be seen by the Pueblo at a number of places (in profusion at Ceremonial Cave) may have deterred these superstitious people, as well as the Plains Indians, from going there unless under strong provocation. This is not true, however, in the Upper Gila, where some sites containing Basket-maker ceremonial objects were occasionally lived in by the Pueblo.

Association would seem to leave no doubt that the dart and stalk pahos and the miniature fending sticks peculiar to the Hueco Ceremonial Cave are of Basket-maker origin. The certainty is but slightly less in regard to twig pahos, split-stick wands, wooden *tablitas*, and reed cigarettes. The last named are widely distributed in the southern area and definitely pertain to its pre-pottery culture.

Ornaments. Numerous hair ornaments from the Upper Gila and Hueco areas, consisting of a single wooden pin to which feathers were attached, or a set of such pins, duplicate the northern Basket-maker types of personal decoration. With these are seed necklaces; beads of sectioned reed; large, discoidal stone beads; and abalone shell pendants, all of which, in association and crudity of appearance, are similar to the northern trinkets.

Wooden Objects. The tree-shell trowel is the same in all areas. It and the wooden dart wrench, especially when the latter is made from broken grooved fending sticks, surely belong to the Basket-maker culture.

Leather Objects. Leather containers are scarce in shelters of the Upper Gila, but from the Hueco area come pouches, similar to those of the San Juan, made of whole rodent skins or of unsplit animal-neck hide, and small stitched medicine pouches suitable for pollen or sacred meal.

Pipes. One large wooden and several short stone pipes of tubular shape can be identified as Basket-maker, although pipes of this type unless found with other Basket-maker artifacts are hard to place because tubular, as well as conical, pipes occur in Pueblo sites.

Bone Objects. Bone objects, such as flakers and punches, present the same difficulty. The only form of awl which has the earmark of antiquity is the short, stubby awl with either a fiber- or leather-padded handle. The horn dart wrench, like those of wood, is of course Basket-maker.

Disposal of the Dead. Methods of disposal of the dead in the San Juan and in the Hueco-Big Bend are essentially similar. Burial in cave refuse or in grass-lined pits was common in both areas. The secondary use of slab-lined cists as graves, frequent in the north, naturally is not duplicated in the south, because slab construction was so seldom employed there. The principal difference in treatment of the dead is that cremation was practised in the Guadalupe Mountains, east of the Huecos, and near the mouth of the Pecos River, in Texas. The burials of calcined bones were accompanied not only by Basket-maker artifacts of San Juan types, but by varieties of offerings that do not occur there—plaited matting, metates, and manos.

With the exception of the Upper Gila area, where only Pueblo burials have been found, the cremations or desiccated flexed bodies were accompanied by fur-cloth blankets, colored twined-woven bags, and coiled baskets. An atlatl in a basket was found with 1 burial, and a basket with another interment held a leather pouch containing meal. Beside the body in this second interment lay a crude imitation of a dart. The general layout of these graves, to say nothing of the Basket-maker objects surrounding them in the cave refuse, shows marked similarity to that in the San Juan.

Head Form. More information is daily coming to light about the skeletal remains from caves in this southeastern area. At present it is understood that skulls reported from the Guadalupe Mountains and the Big Bend are generally undeformed. Whether the majority of these specimens will prove to be mesocephalic, as are 2 crania from the Huecos measured by Dr. George Woodbury, is not known. There are extant a number of collections of Texas Cave Dweller skeletons. These must be measured and studied before the physical characteristics of the aboriginal Texans can be determined with sufficient accuracy to permit an authoritative comparison with the Basket-makers of the San Juan.

Admittedly there were some differences between the material culture of northern and southern Basket-makers. Among the latter, for example, a different type of matting and a more easily fabricated yucca sandal were evolved. The typical San Juan two-rod-and-bundle triangular foundation for coiled basketry was known in the Upper Gila, Hueco, and Guadalupe areas, but farther south was replaced by the more available grass-bundle and half-rod foundations. Although specimens of twined weaving were found in the Big Bend and fragments appeared in the Upper Gila, Hueco and Guadalupe areas, where an excellent twined-woven bag was recovered, farther south this technique was for some reason replaced by the expeditious coiled netting.

Notwithstanding these apparently contradictory elements in the cultural remains, a mass of similar artifacts ties the people of the Upper Gila–Hueco Basket-maker area to their cultural contemporaries in the San Juan: the atlatl, dart, dart wrench, fending stick, tree-shell trowel, primitive type of fur cloth, twined weaving, basketry, having bundle-with-rod-core and two-rod-and-bundle triangular foundations, hair ornaments, and many others. A great number of fending sticks and darts and several atlatls were found in the Upper Gila area and Hueco Mountains. In the latter district, particularly, it was common to find these weapons lying side by side with fish-tail sandals and coiled basketry of the southern bundle type and the northern two-rod-and-bundle triangular type sewed with either yucca or wood splints. Some of these baskets were decorated in the true Basket-maker style. South and east, in the Guadalupe Mountains of New Mexico, the atlatl appears in a grave with typical San Juan basketry and a twined bag. At the mouth of the Pecos and in the Big Bend of Texas, fur cloth, the atlatl, dart, grooved fending stick, and other artifacts make their appearance. In the Upper Gila 7 sites have produced parts of 23 darts, fragments of grooved sticks, and 1 atlatl. From the Hueco area 2 complete atlatls and 4 fragments, great numbers of grooved fending sticks, and 89 complete or fragmentary darts have been recorded. Eighty-three of the darts are from 1 site, Ceremonial Cave, which, as the name indicates, was a shrine, where numbers of these articles were used as offerings. Such a great accumulation, especially at a shrine, points to the presence of a considerable number of Basket-makers in the district.

There are no impassable natural barriers between the San Juan and the Upper Gila-Hueco-Big Bend which would have prevented the nomadic Basket-makers from spreading southward. It is true that the intermediate area revealed no great quantity of Basket-maker artifacts, and no clearly defined Basket-maker caves or house remains; but there is enough evidence to indicate that there was some drift of population along the easily traveled drainage courses—south into the Upper Gila and the Mimbres by way of the Little Colorado and San Francisco, and southeast into the Rio Grande by way of low passes in the Divide.

The feasibility and use of the western route are clearly shown by the plethora of slightly later remains strewn all along it and by the finding of Basket-maker material at several places. The course of the second route, which concerns us most, is shown by the presence of Basket-maker remains at the following sites: Jemez Cave, north of Albuquerque; Laguna Shrine; Sandal Cave, south of San Marcial; the cave near Lava, farther south; and still farther on, near Las Cruces, Chavez and Bishop's Cap Caves. The possibility that a Basket-maker-like people might have migrated to the Hueco area from the south seems unlikely considering that Coahuiltecan influence discernible is slight.

This report does not presume to give the final solution to the problems with which it deals, but merely certain facts which may contribute to their solution. If we were to state our own con-

clusions, they would be that the Hueco Basketmakers were an off-shoot of the San Juan Basketmaker, that they concentrated for a time in the Hueco area, then to some extent spread southeast along the Rio Grande into western Texas and perhaps into Coahuila, Mexico, and that they finally either degenerated or else amalgamated with the succeeding Plains Indians or the more sedentary agricultural races.

There are, of course, other possibilities. Some are now evident, and there may be others that as yet nothing has come to light even to suggest.

COMPARATIVE TABULATION

SAN JUAN BASKET-MAKER	HUECO BASKET-MAKER UPPER GILA DISTRICT	HUECO BASKET-MAKER HUECO DISTRICT	PECOS-BIG BEND BASKET-MAKER
CRANIA			
		Mesocephalic (2 crania, data insufficient)	Dolichocephalic (?)
ARCHITECTURE			
Storage cists: unlined and slab-lined; some roofed	Storage cists: grass-padded; occasionally partly slab-lined		Storage cists, grass-lined
			"Fiber-chinked slab cists" — Pommel Peak, Chisos Mountains
Storage cists: above ground, slab-lined and roofed			
Sleeping cists: unlined and slab-lined; grass and bark padding	Sleeping cists: grass- and leaf-lined; occasionally partly slab-lined or with rough stones piled around them as windbreaks	Sleeping pits: grass-padded	
Burial cists: unlined and slab-lined; some roofed			
Roughly circular slab foundation houses; roofed			Irregularly rounded house foundations of rough stone (1 site only, Bee Cave, Brewster Co., Texas); faintly suggestive of San Juan Basket-maker type
FOOD			
Tropical Flint corn	Tropical Flint corn	Tropical Flint corn	Corn (Tropical Flint?) In Big Bend but not in Pecos River region
Squash	Squash	Squash	Squash
Seeds	Seeds (by inference; small quantities found but not in containers)	Seeds (as in Upper Gila district)	Seeds (as in Upper Gila district)
WEAPONS			
Atlatl	Atlatl	Atlatl	Atlatl
Dart	Dart	Dart	Dart
Grooved fending stick	Grooved fending stick	Grooved fending stick	Grooved fending stick
		Round sinew-wrapped fending stick with grip-end bumper	
Arrow (Late Basket-maker III)		Arrow (Late Basket-maker III); some with bunts, duplicating bunts on darts)	
CLOTHING			
Fur-cloth blanket	Fur-cloth blanket	Fur-cloth blanket	Fur-cloth blanket
Feather cloth (hide cut in strips)			
Apron, yucca string	Apron, yucca string	Apron, yucca string	Apron, fiber string
Apron, bark			
Apron, woven human hair			
SANDALS			
Square toe, twined-woven cord, full length			
Scallop toe, intricately woven cord, full length			
Coarse weave, crushed yucca, full length	One form of full-length (Type 14) sandal, comparable in weave to a San Juan Basket-maker II yucca sandal		

SAN JUAN BASKET-MAKER	HUECO BASKET-MAKER UPPER GILA DISTRICT	HUECO BASKET-MAKER HUECO DISTRICT	PECOS-BIG BEND BASKET-MAKER
SANDALS—continued			
Coarse weave, yucca-fiber cord, full length Twilled yucca leaf, full length Leather moccasin, full length	U-shape, 2-warp yucca toe sandal Two-warp fish-tail yucca toe sandal (1 site)	Three- and 4-warp yucca toe sandal Two-warp fish-tail yucca toe sandal (plentiful) Twilled yucca-leaf toe sandal Two-warp, yucca, full length Note: Toe sandals are positively identified as Basket-maker because of their association with burials and artifacts diagnostic of the culture	U-shape, 2-warp yucca toe sandal Two-warp fish-tail yucca toe sandal (sporadic) Two-warp, yucca, full-length Crude, full length, crushed yucca leaf on 2 warps or roughly intertwined; sometimes reinforced by longitudinal and cross stitching; (this type found at mouth of Pecos River in the Big Bend, Texas, and through the State of Coahuila, Mexico, to its southern border; does not appear in the Hueco district—Sandal referred to as a Coahuila type)
TEXTILES			
Twined weaving: fine weave, designs in color, yucca-fiber cord Twined weaving: coarse weave, no design, yucca-fiber cord Plain weave: apocynum and yucca-fiber cord, buttonhole and twined hair selvage Coiled netting: human hair Coiled netting: fiber cord Knotted coiled netting: fiber cord	Twined weaving: designs in color, yucca-fiber cord	Twined weaving: designs in color, yucca-fiber cord Coiled netting: yucca-fiber cord Knotted coiled netting: yucca-fiber cord	Twined weaving, painted (rare) Coiled netting: yucca-fiber cord Knotted coiled netting: fiber cord
Coiled netting: shredded yucca leaves (on cradle)	Coiled netting: heavy, stripped yucca-leaf carrying nets Coiled netting on warps: colored wefts, yucca-fiber cord	Coiled netting: heavy, stripped yucca-leaf carrying nets	
Cedar-bark bags Yucca-leaf containers	Yucca-leaf containers		
CORDAGE			
Yucca fiber Apocynum fiber Human hair (plentiful) Animal hair	Yucca fiber Human hair (rare) Animal hair (rare)	Yucca fiber Human hair (rare) Animal hair (rare)	Yucca fiber Human hair (rare) Animal hair (bison hair sometimes used)
NETTING			
Large rabbit nets: apocynum cord Rabbit net: combination of human hair and fiber cord	Fragments of large mesh nets: yucca-fiber cord	Fragments of large mesh nets: yucca-fiber cord	Large mesh nets: yucca-fiber cord, (complete bags, dip nets, seine or rabbit net)

SAN JUAN BASKET-MAKER	HUECO BASKET-MAKER UPPER GILA DISTRICT	HUECO BASKET-MAKER HUECO DISTRICT	PECOS-BIG BEND BASKET-MAKER
BASKETRY			
Standard technique 1. Two-rod-and-bundle triangular foundation, uninterlocked stitch, wood sewing element	Standard technique 1. Two-rod-and-bundle triangular foundation, uninterlocked stitch, wood sewing element	Standard techniques 1. Half-rod or bundle foundation, split or interlocked stitch, yucca or sotol sewing element 2. Two-rod-and-bundle triangular foundation, uninterlocked stitches, yucca or sotol sewing element 3. Rod-with-lateral-bundle foundation, split or interlocked stitches, yucca or sotol sewing element	Standard technique 1. Bundle foundation (widely varying in material and texture), split or interlocked stitches, yucca or sotol sewing elements
Sifter coiling fairly common	Sifter coiling known For less common techniques and relationships, see Discussion of Coiled Basketry, pp. 105–10 and figure 33		
BASKETRY—COARSE COILING			
		Massive fiber bundle, interlocked stitch, sotol sewing element	Massive fiber bundle, interlocked stitch, sotol sewing element
BASKETRY—PLAITED AND TWILLED			
Yucca-plant basket	Yucca-leaf basket and basket-like leaf container	Checkerweave: yucca leaves	Yucca leaves, plain twined Yucca leaves, openwork twined Checkerweave: yucca leaves
BASKETRY FORMS			
Large tray Small tray Deep direct side Conical (carrying basket) Seed jar shape	Small tray	Large tray (majority) Small tray (minority) Deep direct side Conical (carrying basket)	Large tray Deep direct side
MATTING			
Tie-twined bundle: bark, rush, yucca, grass Twined sewed bundle: bark, rush, mashed yucca leaves, grass	Tie-twined bundle: rush	Tie-twined bundle: soft grass or grass stems Twilled weave: whole and split yucca leaves Checkerweave: whole and split yucca leaves	Tie-twined: fiber Twilled weave: whole and split yucca leaves Checkerweave: whole and split yucca leaves
SNARES			
Hinged stick Running noose Running noose with hondo Running noose with toggle Net snare Bird snare (twig and hair noose)	Hinged stick	Hinged stick Running noose	

SAN JUAN BASKET-MAKER	HUECO BASKET-MAKER UPPER GILA DISTRICT	HUECO BASKET-MAKER HUECO DISTRICT	PECOS-BIG BEND BASKET-MAKER
CRADLES			
Rigid frame, twig back, guitar shape			Rigid frame, twig back, forked frame
			Rigid frame, slat back, V-shape frame
			Semi-rigid frame, rods boat-shaped
Flexible grass-bundle frame, yucca-leaf back, guitar shape			
Flexible cedar bark	Flexible bear-grass leaf		
UMBILICAL PADS			
Rigid or semi-rigid core covered with rodent skin			
LEATHER			
Pouch of whole pelt (rodent)		Pouch of whole pelt (rodent)	
Pouch of antelope neck		Pouch of antelope neck	
Medicine pouch		Medicine pouch (bottle-neck)	Leather pouch (envelope-shaped)
POTTERY			
Unfired, no temper			
Unfired, vegetable temper			
Fired plain gray, grit temper, granular surface			
Fired, black decoration on gray, grit temper, granular surface			
Red ware, grit temper, slightly granular surface			
Unfired funnel-like object			
PIPES			
Short, tubular, stone		Short, tubular, stone	Short, tubular, stone
Short, tubular, clay			
Short, tubular, wood, bone mouthpiece	Large, tubular, wood (native walnut), bone mouthpiece		
Funnel-like clay			
TOOLS			
Tree-shell trowel	Tree-shell trowel	Tree-shell trowel	Tree-shell trowel
Spindle with cross stick for whorl			
		Wooden dart wrench	Wooden dart wrench
Horn dart wrench		Horn dart wrench	
Short, padded-handle bone awl		Short, padded-handle bone awl	
Hafted bone flaking tool			
Horn-blade digging stick			
ORNAMENTS			
Hair ornament	Hair ornament	Hair ornament	
Large, hemispherical stone beads	Large, hemispherical stone beads		
Large, spherical stone beads			
Large, discoidal stone beads		Large, discoidal stone beads	
Necklaces of seed beads		Necklaces of seed beads	Necklaces of seed beads
Reed beads		Reed beads	Reed beads
Olivella shell beads	*Olivella* shell beads	*Olivella* shell beads	*Olivella* shell beads
Abalone shell pendants		Abalone shell pendants	
		Mussel shell pendants	Mussel shell pendants
Turquoise mosaic (from Canyon del Muerto)		Turquoise mosaic (on basketry arm band)	
		Abalone shell mosaic (on wooden combs)	

SAN JUAN BASKET-MAKER	HUECO BASKET-MAKER UPPER GILA DISTRICT	HUECO BASKET-MAKER HUECO DISTRICT	PECOS-BIG BEND BASKET-MAKER
CEREMONIAL OBJECTS			
Lenticular bone dice	Bone dice (rectangular with rounded corners); 1 pair tied together		
Discoidal bone dice			
Compound dice of stone, bone, or wood			
Long decorated bone tubes, usually in pairs and capped with compound dice			
Fiber-wrapped rodent jaw		Fiber-wrapped rodent jaw	
Medicine pouch		Medicine pouch	
		Miniature grooved and incised fending stick	
	Split-stick wand	Split-stick wand	
	Wooden *tablita* } Possibly late	Wooden *tablita* } Possibly late	Wooden *tablita* ? (rare)
	Reed cigarette } Basket-maker	Reed cigarette } Basket-maker	Reed cigarette
		Dart paho	
		Stalk paho	
	Unpeeled twig paho	Unpeeled twig paho	
FIGURINES			
Unfired clay			Unfired clay (Bee Cave, Brewster Co., Texas)
BURIAL CUSTOMS			
In excavated cists in caves		Excavated in cave rubbish	Excavated in cave rubbish
In grass-lined cists in caves			In grass-lined pits in cave rubbish
In part slab-lined cists			
In slab-lined cists			
In roofed cists		One grave covered with mat of twigs and tule	Graves with stone slabs, cactus, and brush above
Bodies flexed		Bodies flexed	Bodies flexed: 1 reported burial with body at length
Bundle burials			
		Cremation burials (Guadalupe Mountains)	Cremation burials (mouth of Pecos River)
Furniture: fur-cloth blankets; twined-woven bags; square- and scallop-toe sandals; rod-and-bundle, wood-splint-sewed coiled baskets, cradles (rigid frame, flexible bundle frame, cedar bark); hair ornaments; hair, bark and string aprons; leather pouches; atlatls; darts; dart foreshafts; grooved fending sticks		Furniture with unburned bodies: fur cloth; fish-tail sandals; twined weaving; rod-and-bundle, wood-splint-sewed coiled baskets; plaited basket; pollen pouch	Furniture with unburned bodies: fur-cloth blankets; plaited mats (some painted); coiled baskets (bundle foundation, yucca-sewed); rigid frame cradles; netting; dip net; metates; manos; leather pouch (envelope-shaped)
		Furniture with cremations: twined bags; rod and wood-splint-sewed coiled baskets; seed beads; atlatl	Furniture with cremations: plaited mats; netting; metates; manos

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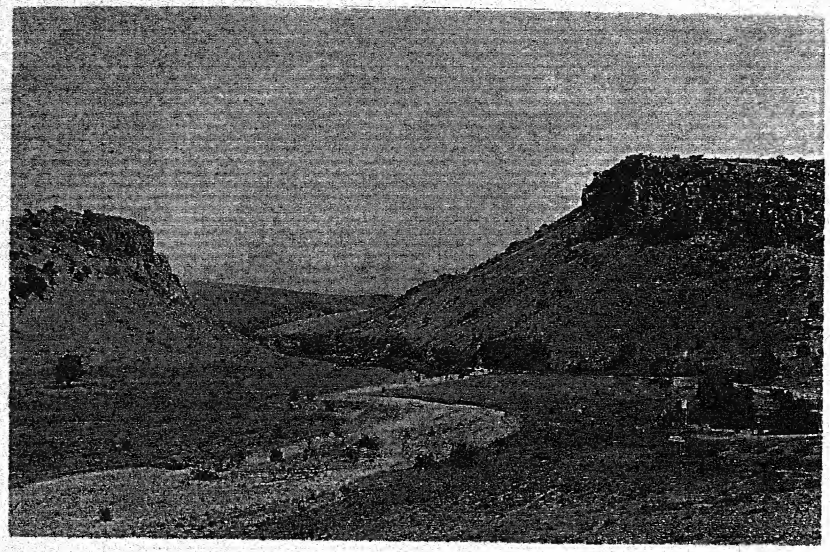
COLLOTYPE FIGURES 49-149



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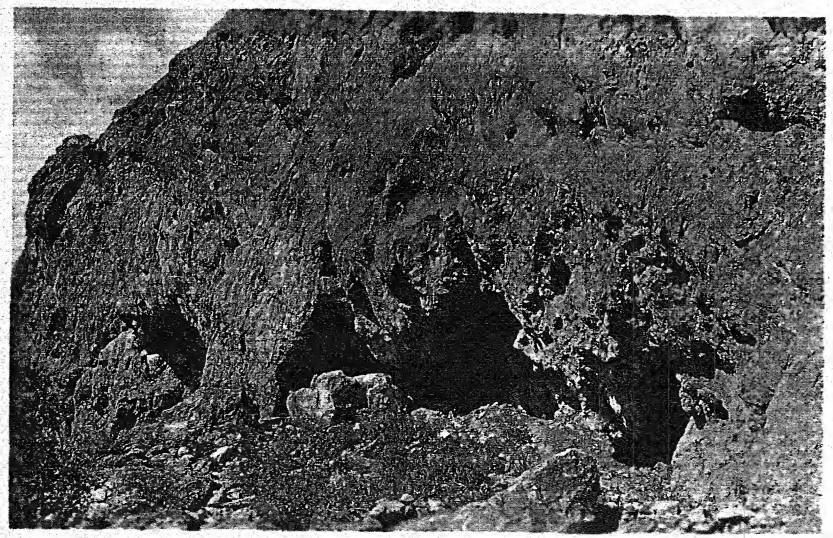

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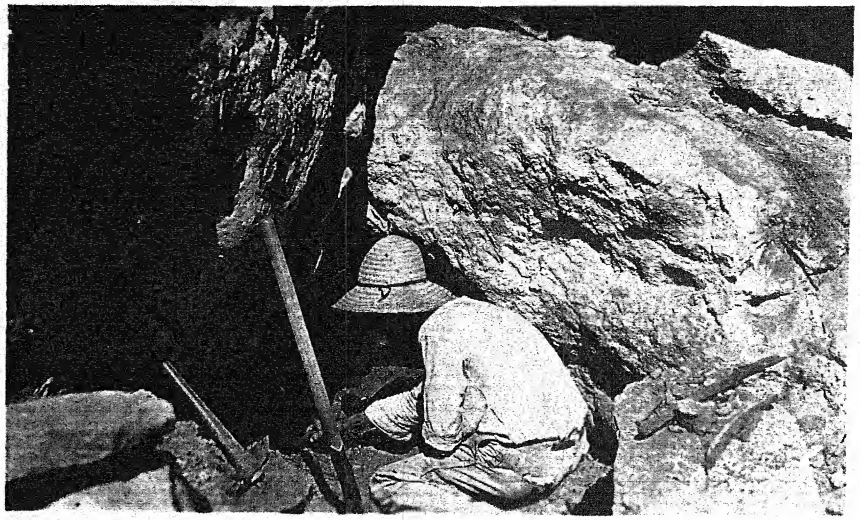
FIG. 49



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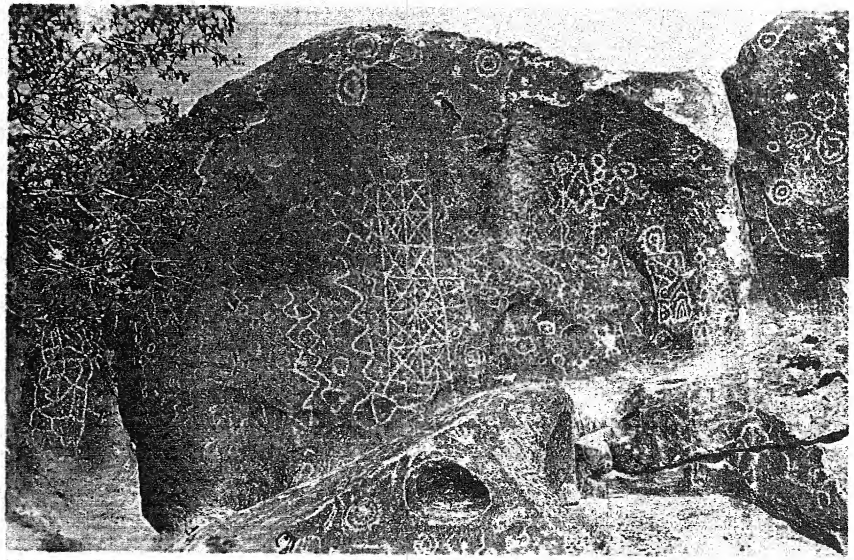

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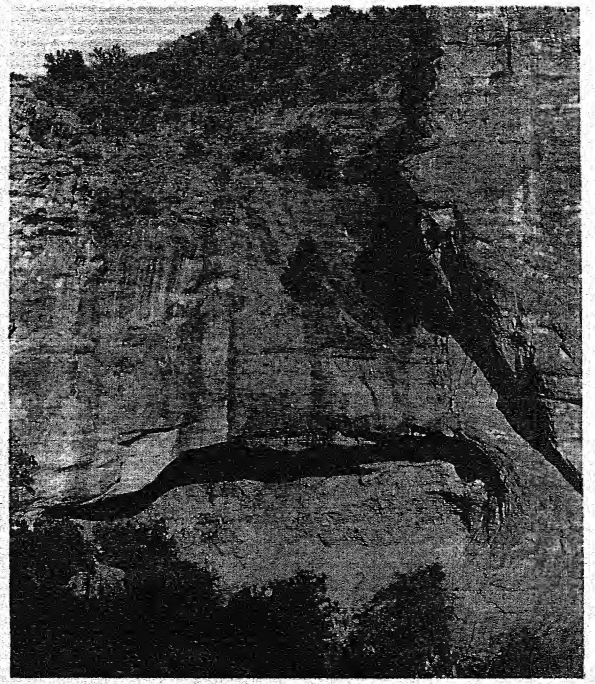
FIG. 50

FIG. 49. *a*, looking south from Doolittle Cave, Cook's Peak in distance (Doolittle Ranch to the right); *b*, Doolittle Cave, east side of canyon tributary to the Mimbres River (about 3½ miles southwest of the Swarts Ruin). (See p. 7.)

FIG. 50. *a*, excavating below boulders at front of Doolittle Cave (dust masks essential in this type of work) (p. 7); *b*, petroglyphs near Rock House Ruin, Mimbres Valley (p. 155).



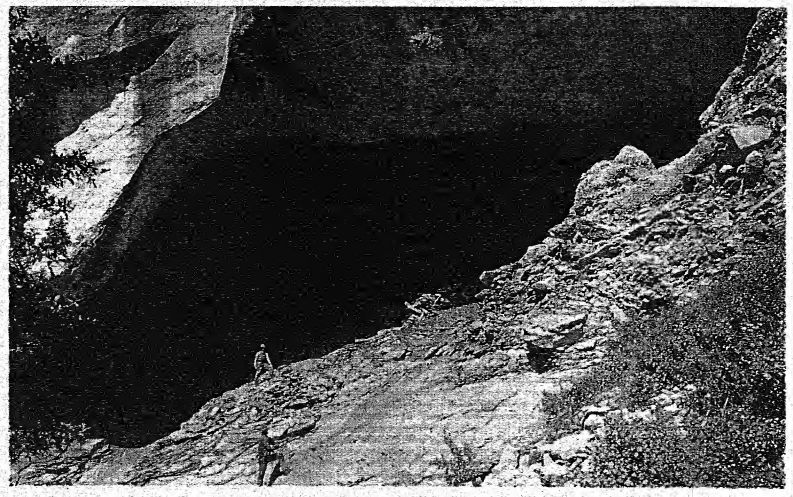
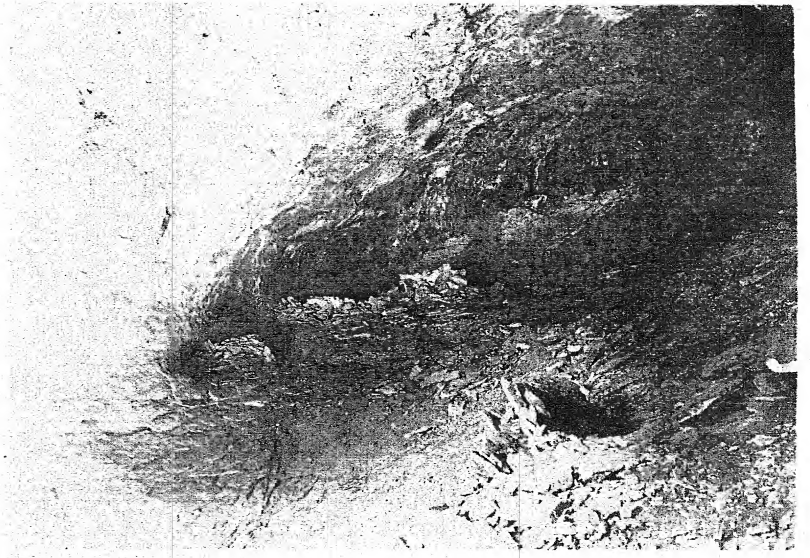


FIG. 51



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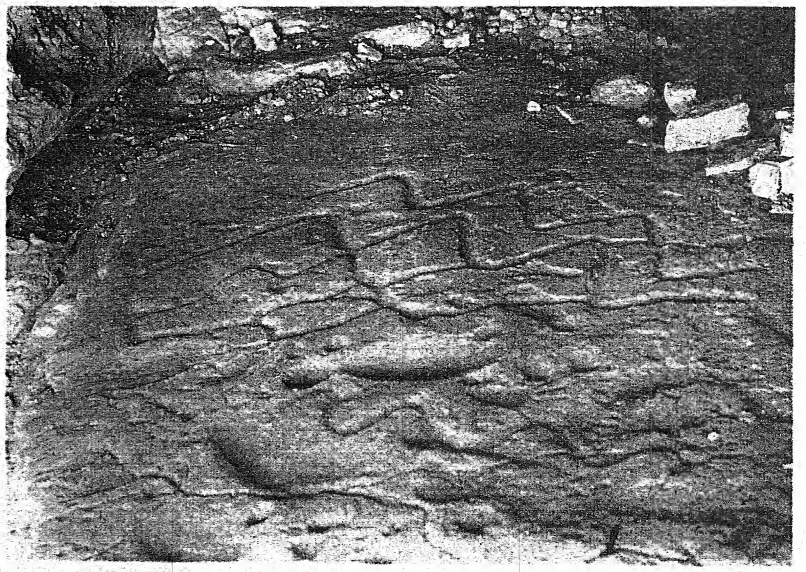
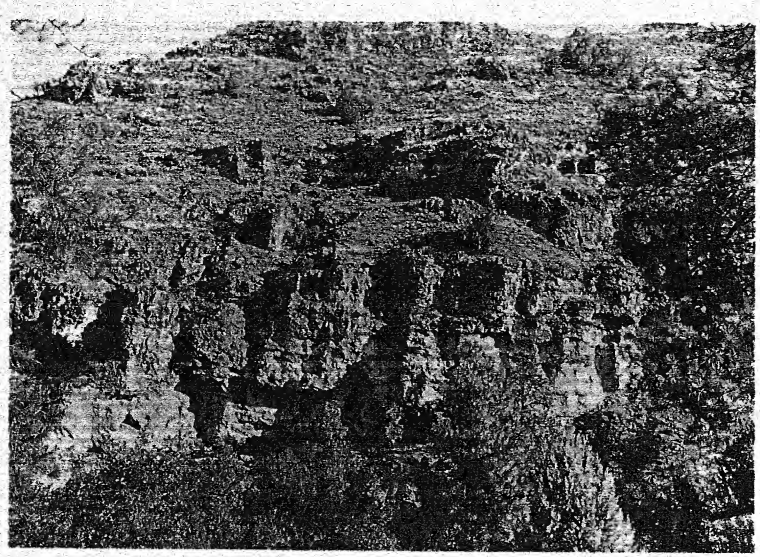


FIG. 52 *b*

FIG. 51. Steamboat Cave in Steamboat Canyon, tributary to Bear Creek, Gila drainage (See pp. 10–13).

FIG. 52. *a*, breastworks in Steamboat Cave (p. 11); *b*, soft white caliche floor in small cave adjacent to Saddle Mountain Cliff Ruin, San Francisco River drainage, incised with figures depicting trails (?), marks of human feet, turkey and bear tracks, also depressions worn from sharpening stone tools (p. 25).



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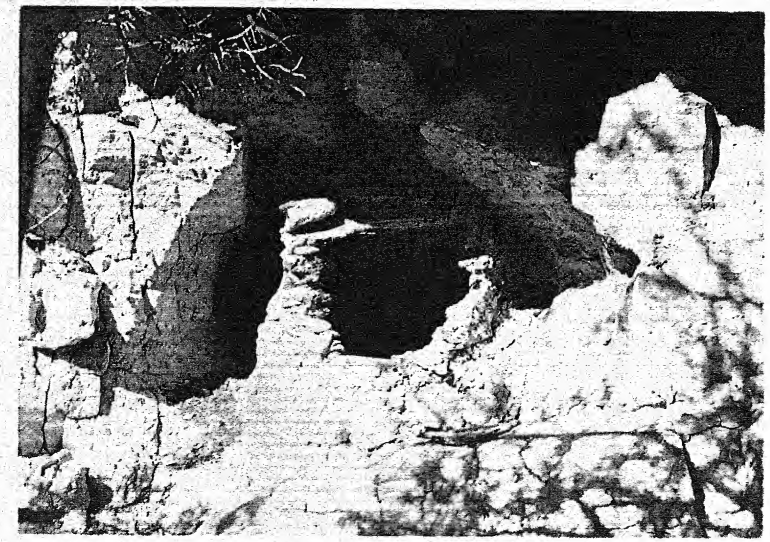

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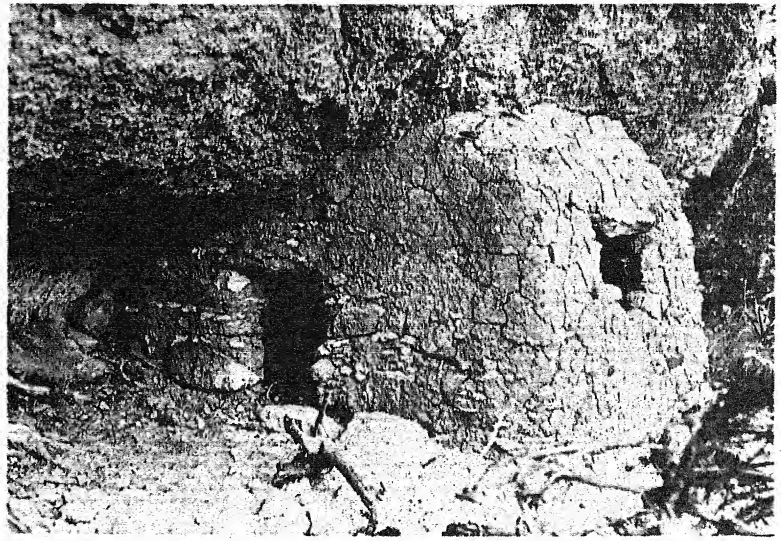
FIG. 53



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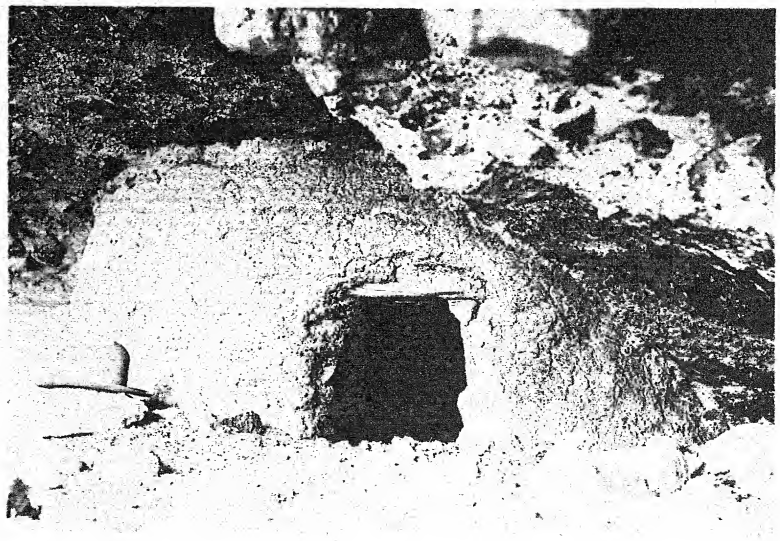

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FIG. 54

FIG. 53. *a*, Site 7, Sapillo Cliff Ruin at mouth of Sapillo Creek on Gila River (p. 15); *b*, granary near G O S Ranch, Sapillo Creek (p. 16).

FIG. 54. *a*, S A Canyon, Cliff Ruin 1 (pp. 16–17); *b*, S A Canyon, Cliff Ruin 2 (p. 17).

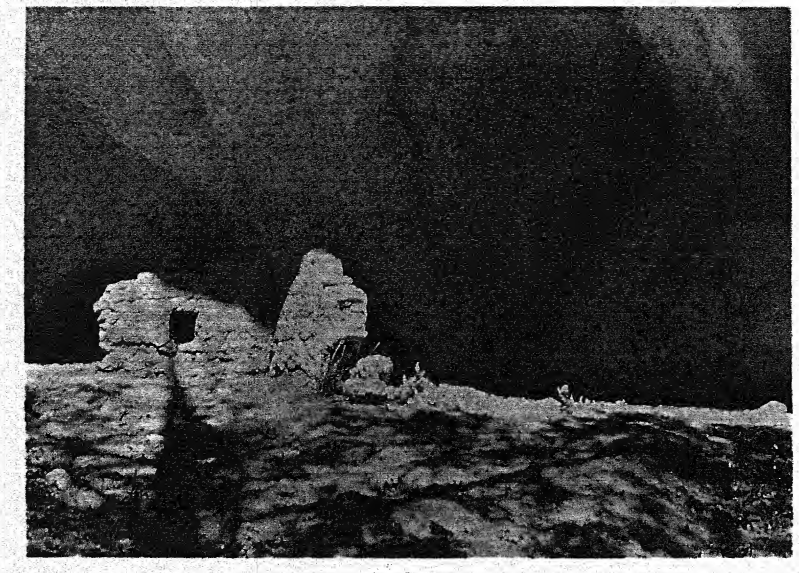

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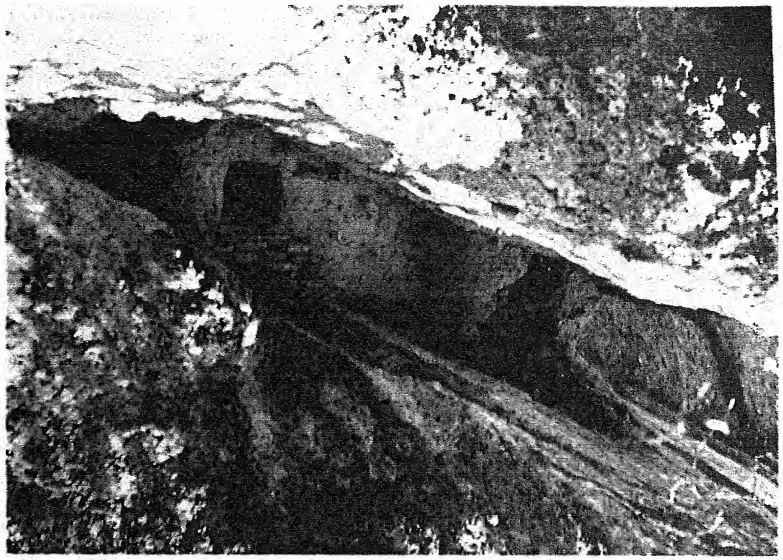
FIG. 55



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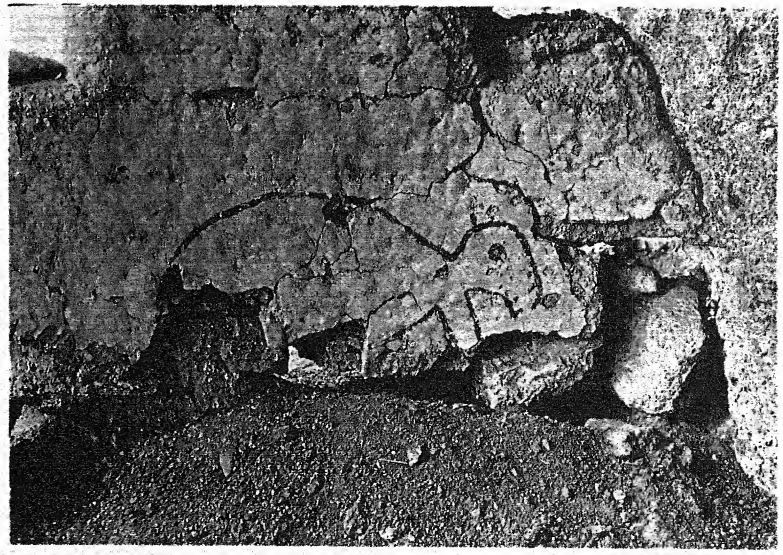
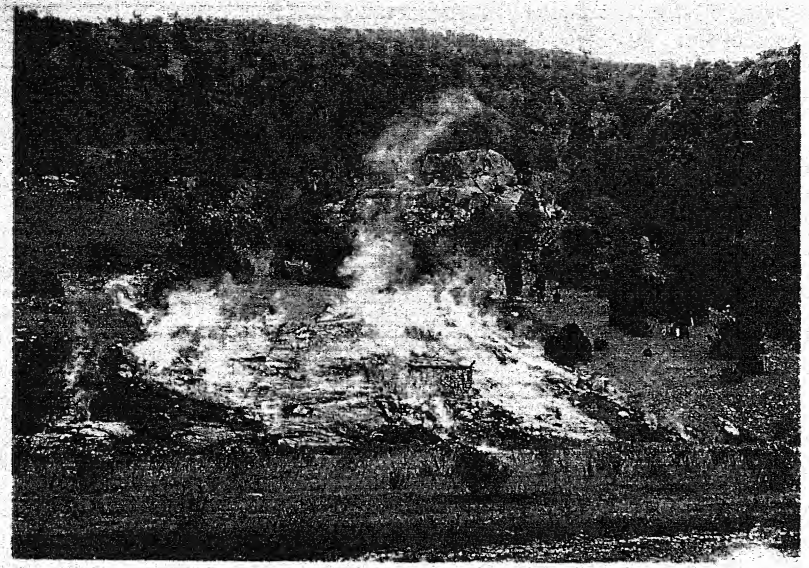


b

FIG. 56

FIG. 55. *a*, Cliff Ruins 1 (left) and 2 (right), Middle Fork of Gila River (p. 18); *b*, Cliff Ruin 7, granary, Middle Fork of Gila River (p. 19).

FIG. 56. *a*, Cliff Ruins 3 (left) and 4 (right), Middle Fork of Gila River; *b*, pictograph on wall of Cliff Ruin 2, Middle Fork of Gila River. (See p. 19.)



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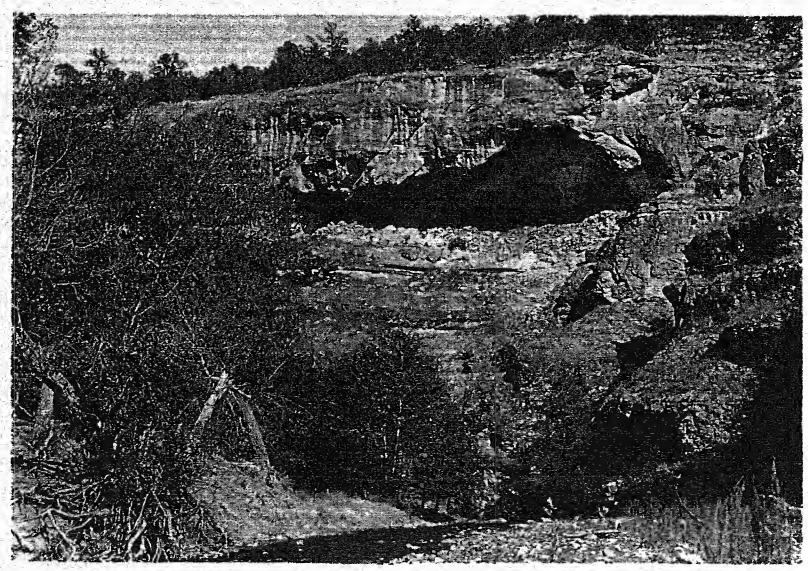
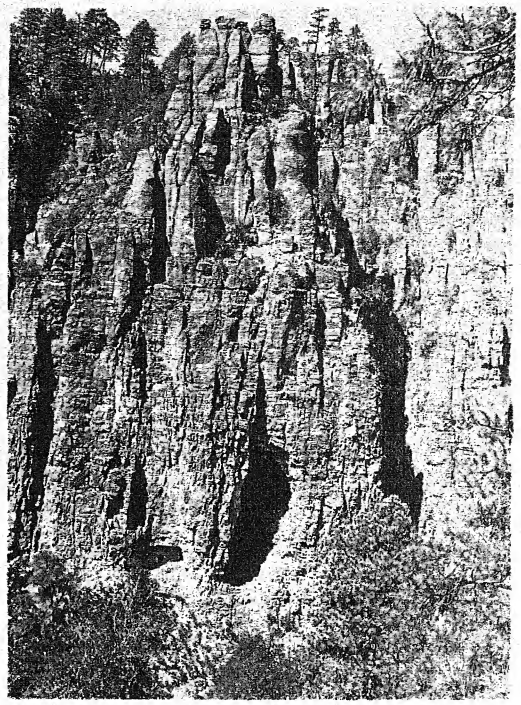


b

FIG. 57



a

b

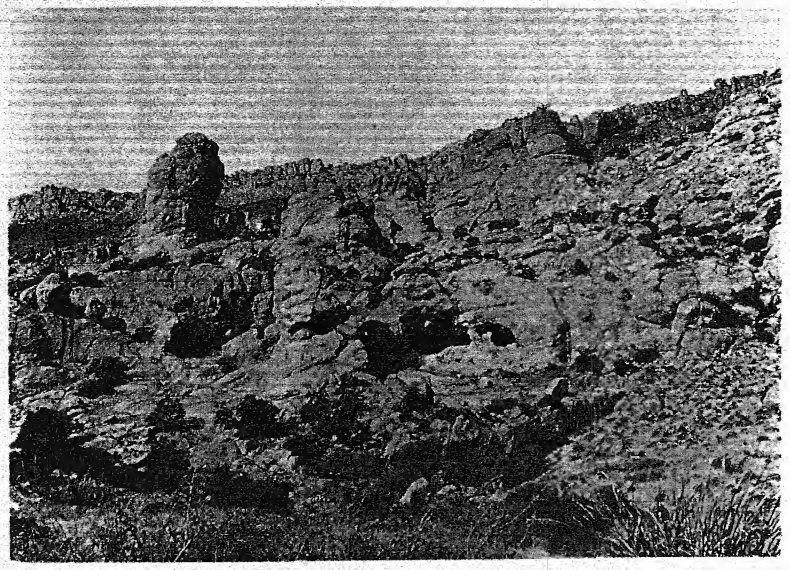
FIG. 58

FIG. 57. *a*, Gila Hot Springs, Upper Gila River (p. 17); *b*, Cave 1, Middle Fork of Gila River (p. 20).

FIG. 58. *a*, Cave 3, West Fork of Gila River (p. 23); *b*, Cliff Ruin 2, West Fork of Gila River (shown in *a* at left of cave entrance) (p. 22).

FIG. 59

a, Saddle Mountain Cliff Ruin, Pueblo Creek, tributary to the San Francisco River (p. 23); *b*, Mule Creek Cave, San Francisco River drainage (p. 29); *c*, ladder improvised to enter Saddle Mountain Cliff Ruin (p. 25); *d*, San Francisco River Canyon, looking south from Table Top Mountain caves, east of Goat Basin (p. 28).



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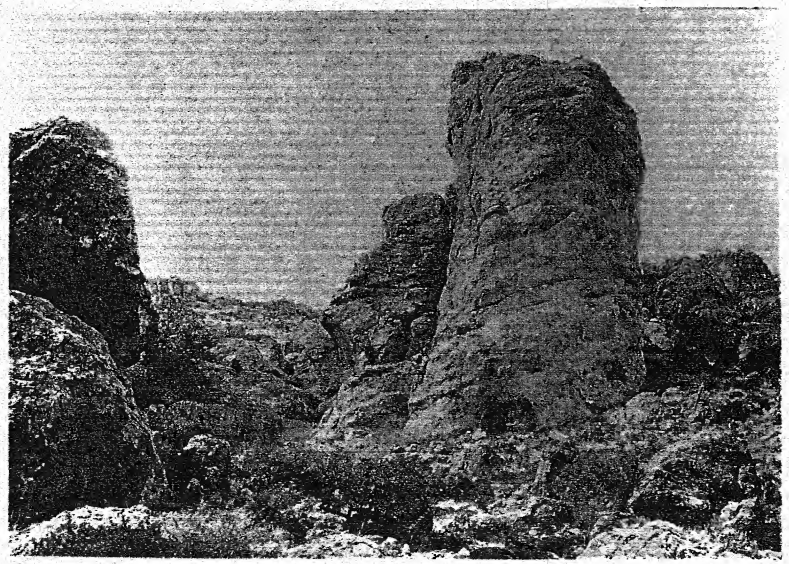
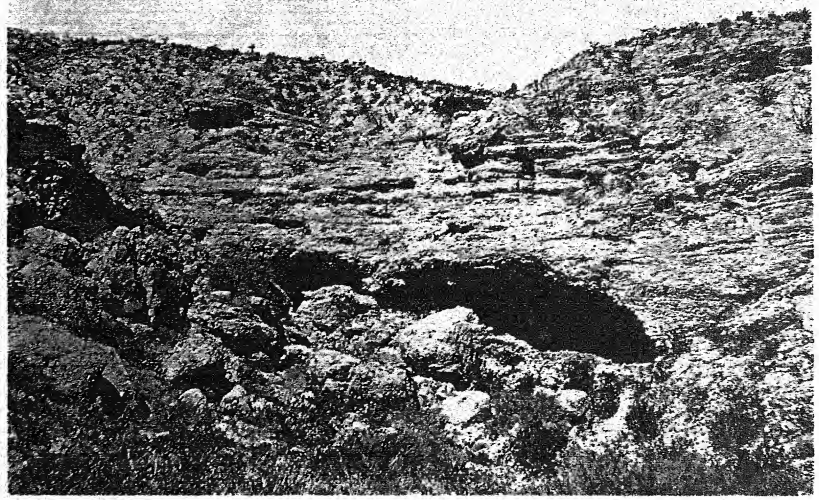


b

FIG. 60

a

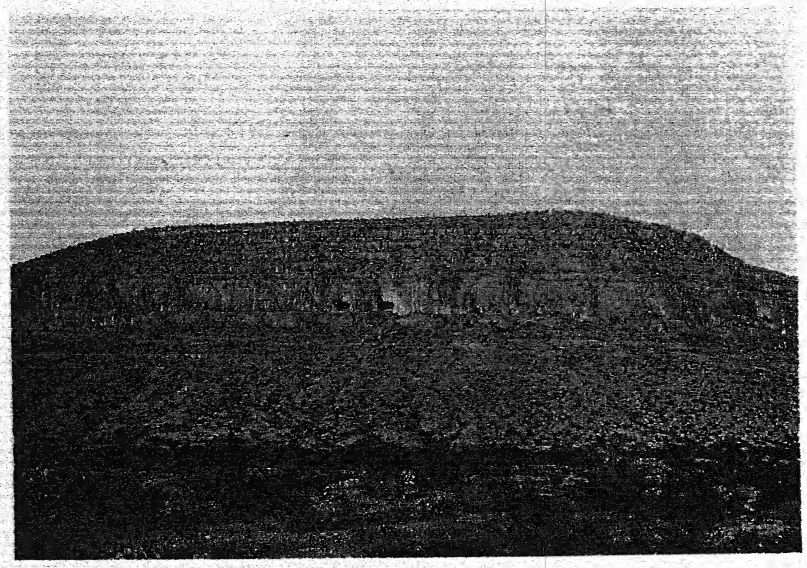


b

FIG. 61

FIG. 60. *a*, Cave 5 (Picture Cave); *b*, Cave 6 (Pinnacle Cave), Playas district. (See p. 41.)

FIG. 61. *a*, Rio Grande and valley east of Chavez Cave, Dona Ana Mountains in background to northeast; *b*, Chavez Cave. (See p. 31.)



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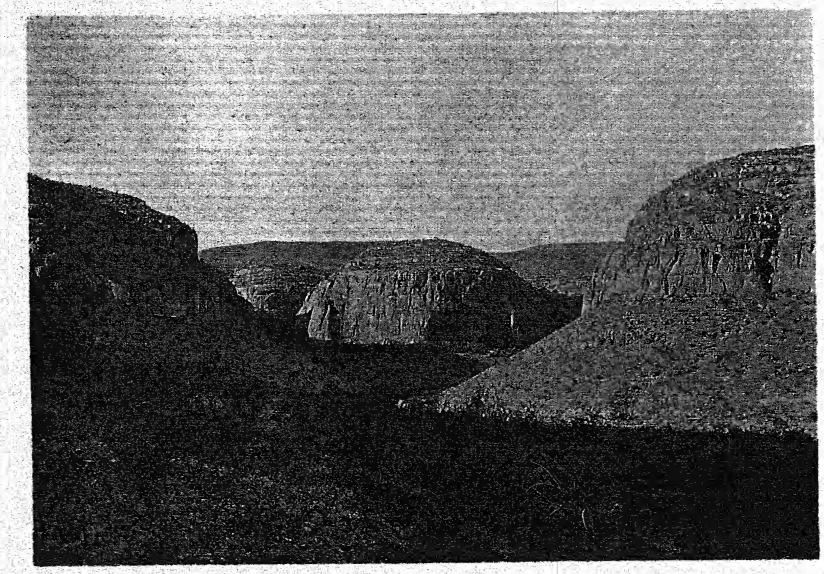
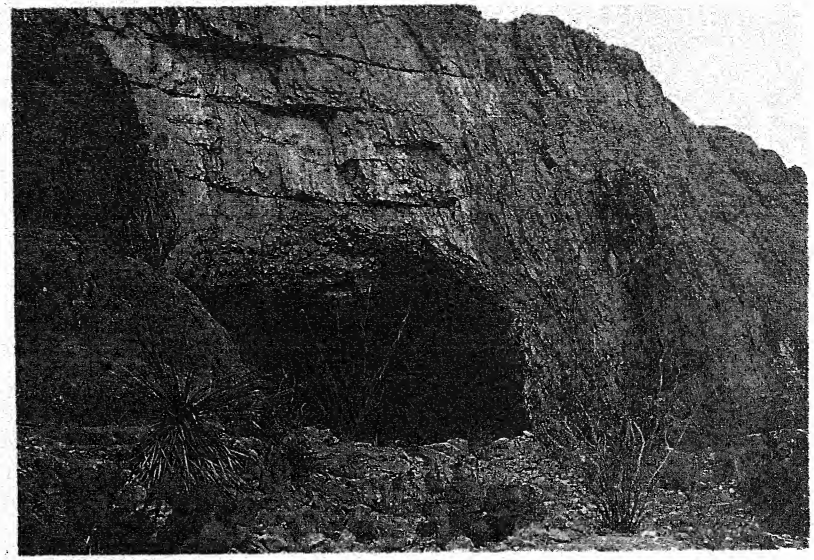


b

FIG. 62



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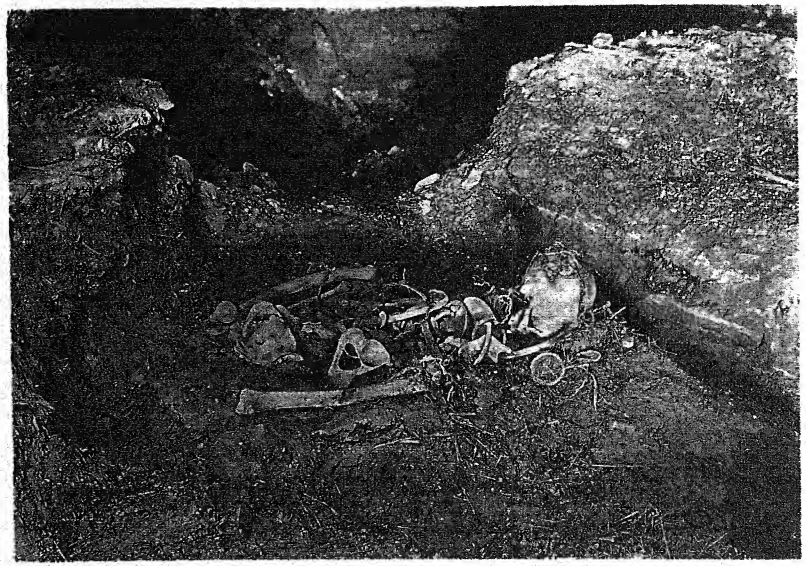


b

FIG. 63

FIG. 62. *a*, Caves 4–7 (left to right), Hueco Mountains, as seen from base camp (p. 38); *b*, typical Hueco Mountain escarpment (p. 33).

FIG 63. *a*, Ceremonial Cave, Hueco Mountains (p. 34); *b*, disturbed burial in Ceremonial Cave (p. 161).

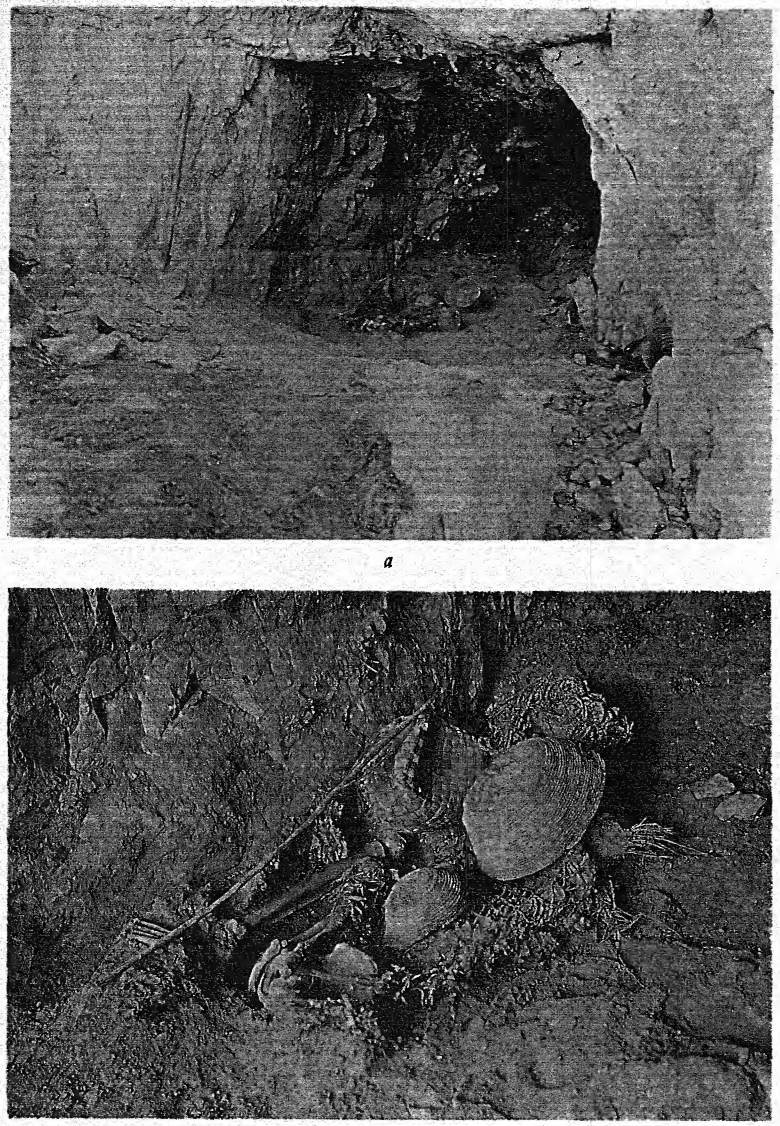


FIG. 64

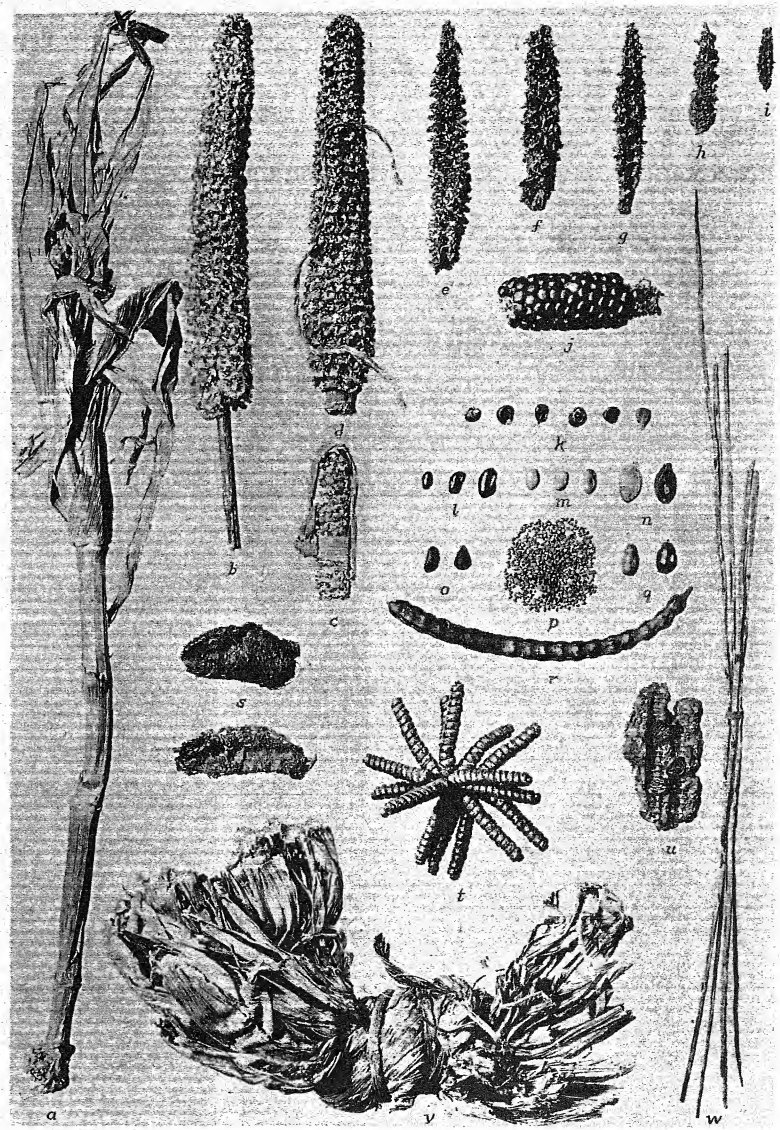


FIG. 65

FIG. 64. *a*, Cave 1 and burial, Hueco Mountains; *b*, infant and adult burial, Cave 1, Hueco Mountains. (See p. 161.)

FIG. 65. EVIDENCE OF SOME OF THE ABORIGINAL VEGETAL FOODS. *a-d*, *k*, Steamboat Cave; *e-i*, Hueco Mountains; *j*, *s*, *t*, Chavez Cave; *l*, *m*, *o*, Kelly Cave; *n*, Cave 1, Middle Fork of Gila River; *p*, *r*, *u*, *w*, Ceremonial Cave; *q*, Cave 9, Table Top Mountain; *v*, Cliff House 1, S A Canyon, Gila National Monument. *a-k*, *v*, corn (p. 44); *l*, *m*, black and white beans (p. 44); *n*, squash seeds; *o*, piñon nuts; *p*, grass seeds; *q*, acorns; *r*, mesquite bean; *s*, quids of agave; *t*, tornillo beans; *u*, yucca pod and seeds; *w*, flail for threshing out grass seeds. (See pp. 44–45, for *a-v*; p. 148, for *w*.) *a*, 17⅝ inches long.

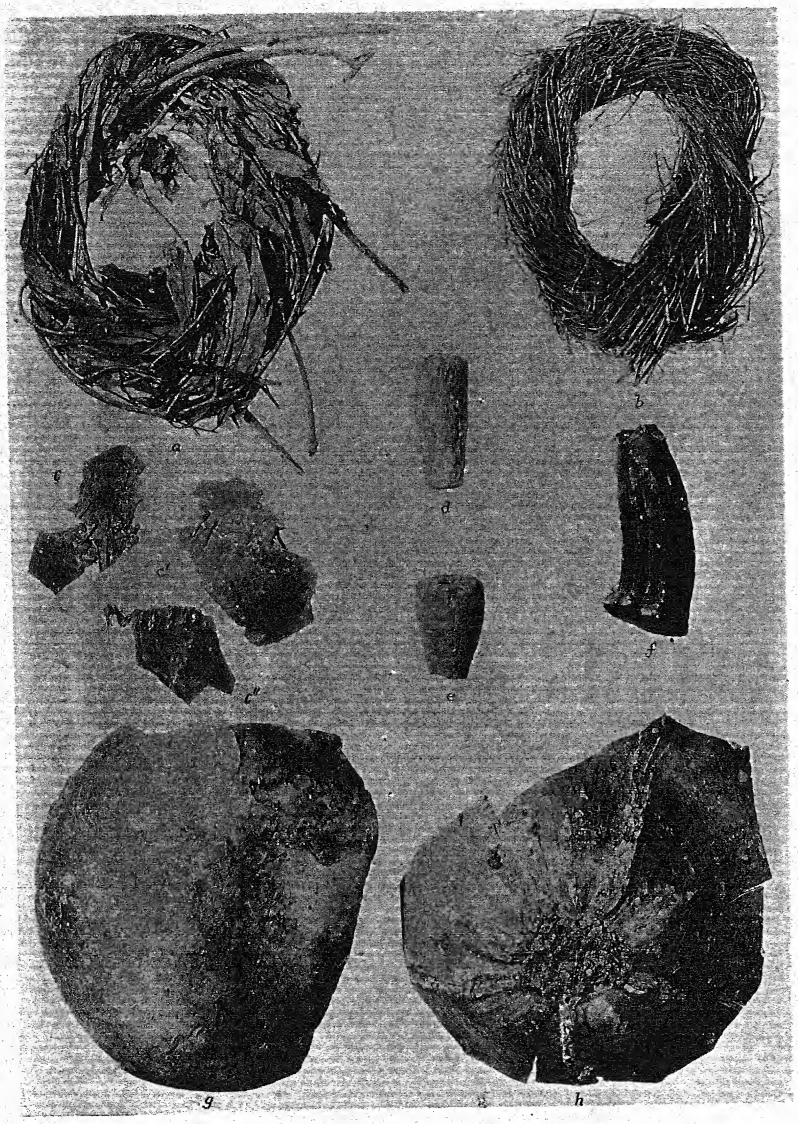


FIG. 66

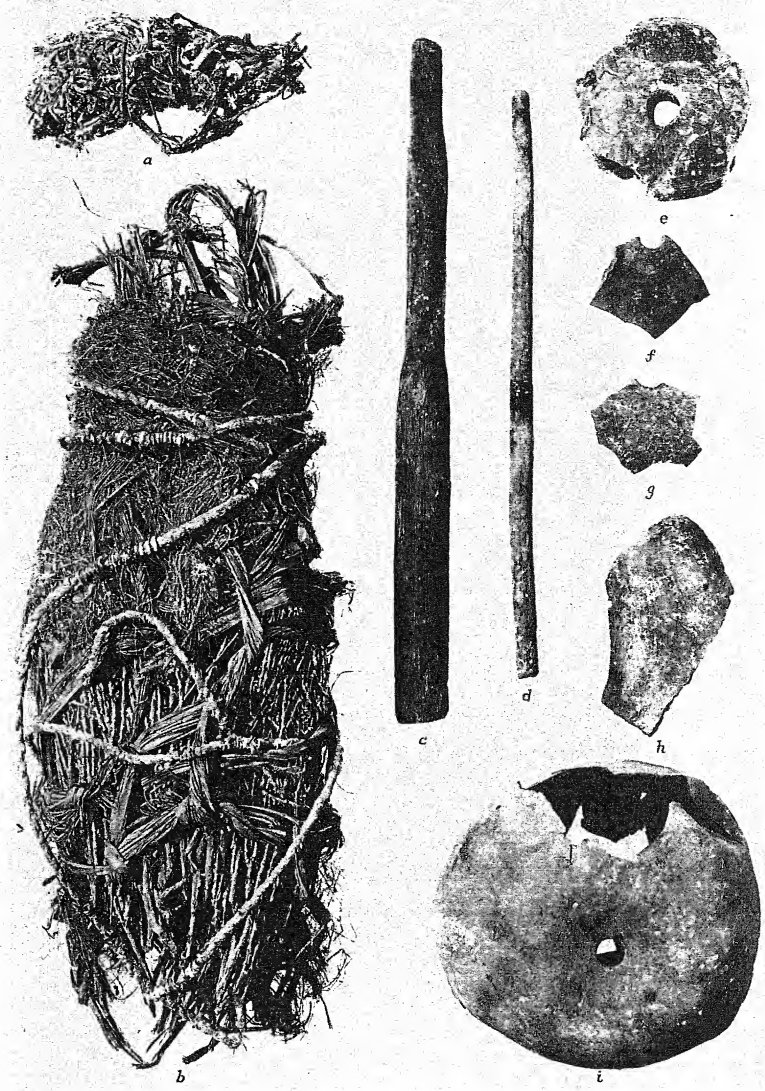


FIG. 67

FIG. 66. *a*, Cave 1, Middle Fork of Gila River; *b*, Ceremonial Cave; *c*, Cliff House, mouth of Sapillo Canyon; *c'*, Cliff Ruin 17, Gila River, *c''*, Cave 1, Hueco Mountains; *d*, Doolittle Cave; *e*, Greenwood Cave; *f*, Kelly Cave; *g*, *h*, Mule Creek Cave. *a*, *b*, pot rests (pp. 20, 36); *c*, *g*, fragments of gourd (p. 149); *d*, *e*, wooden stoppers (p. 149); *f*, *h*, squash stem and rind (pp. 45, 149). *h*, 6 inches in diameter.

FIG. 67. *a*, *c*, *d*, *f-h*, Doolittle Cave; *b*, Cave 1, Middle Fork of Gila River; *e*, Chavez Cave; *i*, Mule Creek Cave. *a*, *b*, bundles of herbs; *c*, *d*, rattle handles; *e*, turtle-shell rattle; *f-i*, fragments of gourd rattles. (See p. 47, for *a*, *b*; p. 120, for *c-i*.) *b*, 13 inches long.

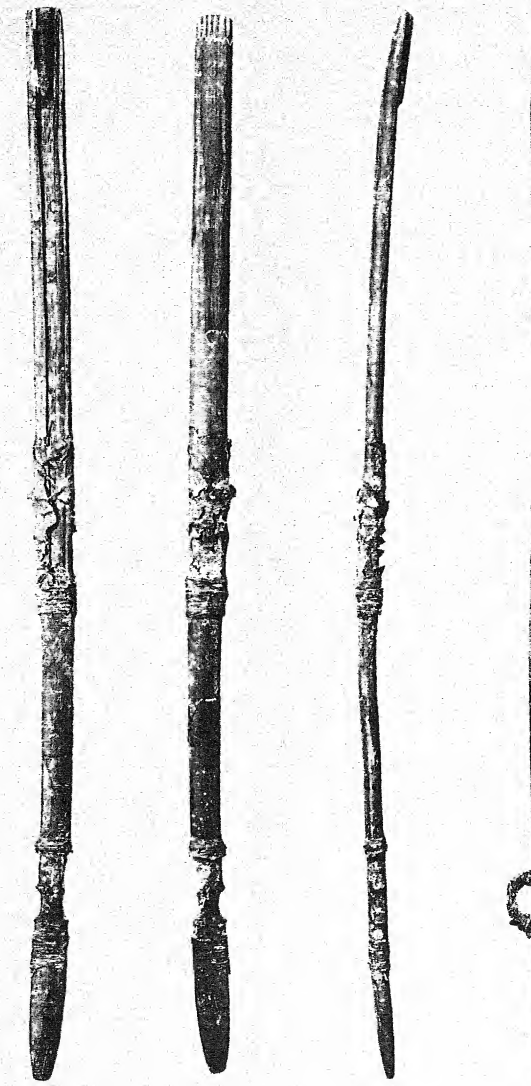


FIG. 68

FIG. 69

FIG. 68. FRAGMENTARY AND NEAR-COMPLETE ATLATLS. *a*, *b*, *d-g*, Ceremonial Cave; *c*, Chavez Cave. *a-a''*, face, back, and edge of same atlatl; *b*, provided with finger loops; *c*, small knot of wood near proximal end to prevent checking; *d-f*, proximal ends; *g*, atlatl weight or charm. (See pp. 48–50.) *a*, 24¼ inches long.

FIG. 69. DARTS FROM THE HUECO AREA. *a*, *b*, *d*, *f-l*, *n-q*, Ceremonial Cave; *c*, Chavez Cave; *e*, *m*, Cave 6, Hueco Mountains. *a-e*, stone-tipped foreshafts; *f-h*, *j*, dart bunts; *k-n*, pointed wooden foreshafts; *o*, dart without foreshaft; *p*, proximal end; *q*, distal end. (See pp. 50–52.) *e*, 10½ inches long.

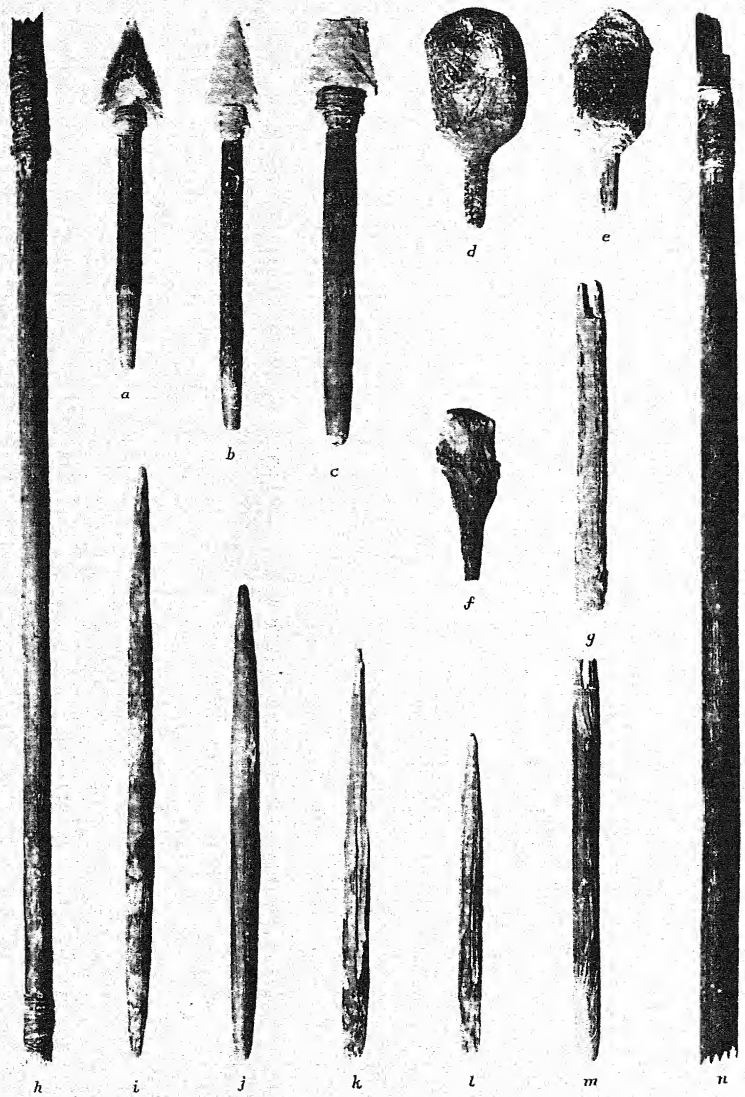


FIG. 70

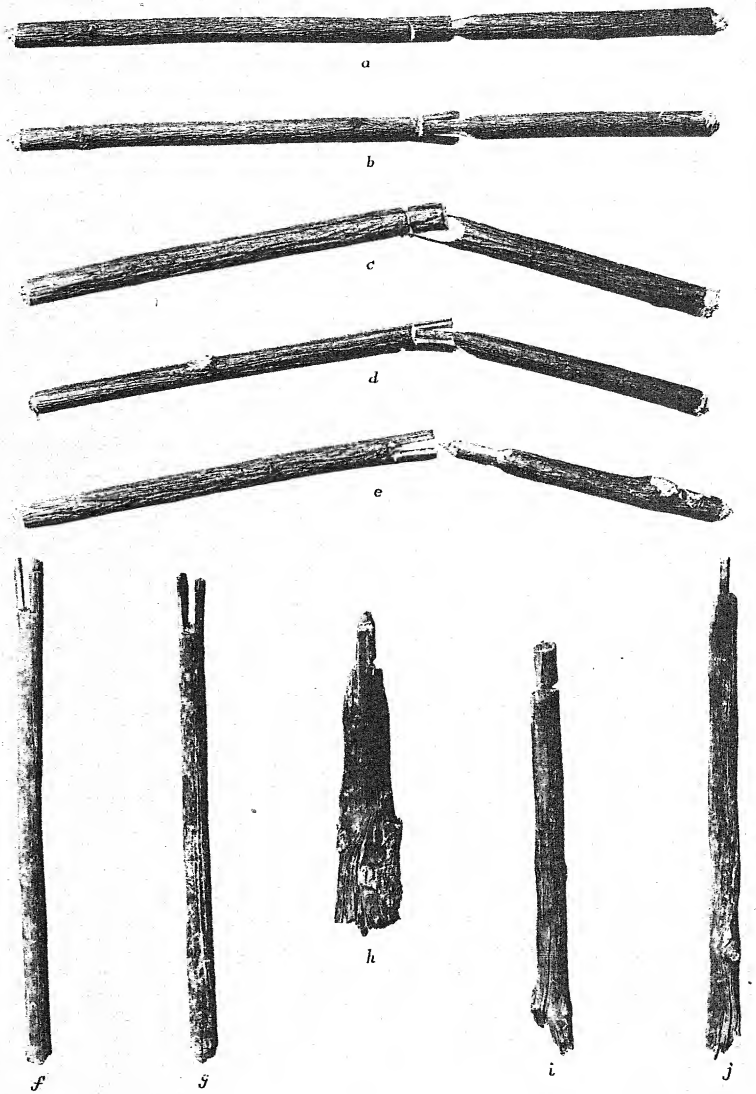


FIG. 71

FIG. 70. DARTS FROM THE UPPER GILA AREA. *a-e*, *g*, *k-m*, Steamboat Cave; *f*, Cave 1, Middle Fork of Gila River; *j*, Cave 1, Goat Basin; *h*, *n*, Sipe Canyon Cave; *i*, Gila National Monument. *a-c*, stone-tipped foreshafts; *d-f*, dart bunts; *g*, *m*, nocks; *i-l*, pointed wooden foreshafts. (See pp. 54–56.) *i*, 8⅜ inches long.

FIG. 71. PROCESS OF FORMING NOCKS. *f*, *g*, Ceremonial Cave; *h*, *j*, Steamboat Cave; *i*, Site 3, Gila River, cave above Shelley Canyon. *a-e*, process of notching dart foreshafts to seat stone point; *f*, *g*, unfinished notched dart foreshafts from cave refuse; *h-j*, discards with tenon on end the result of forming the nock. (See pp. 52–54.) *a*, 8⅝ inches long.

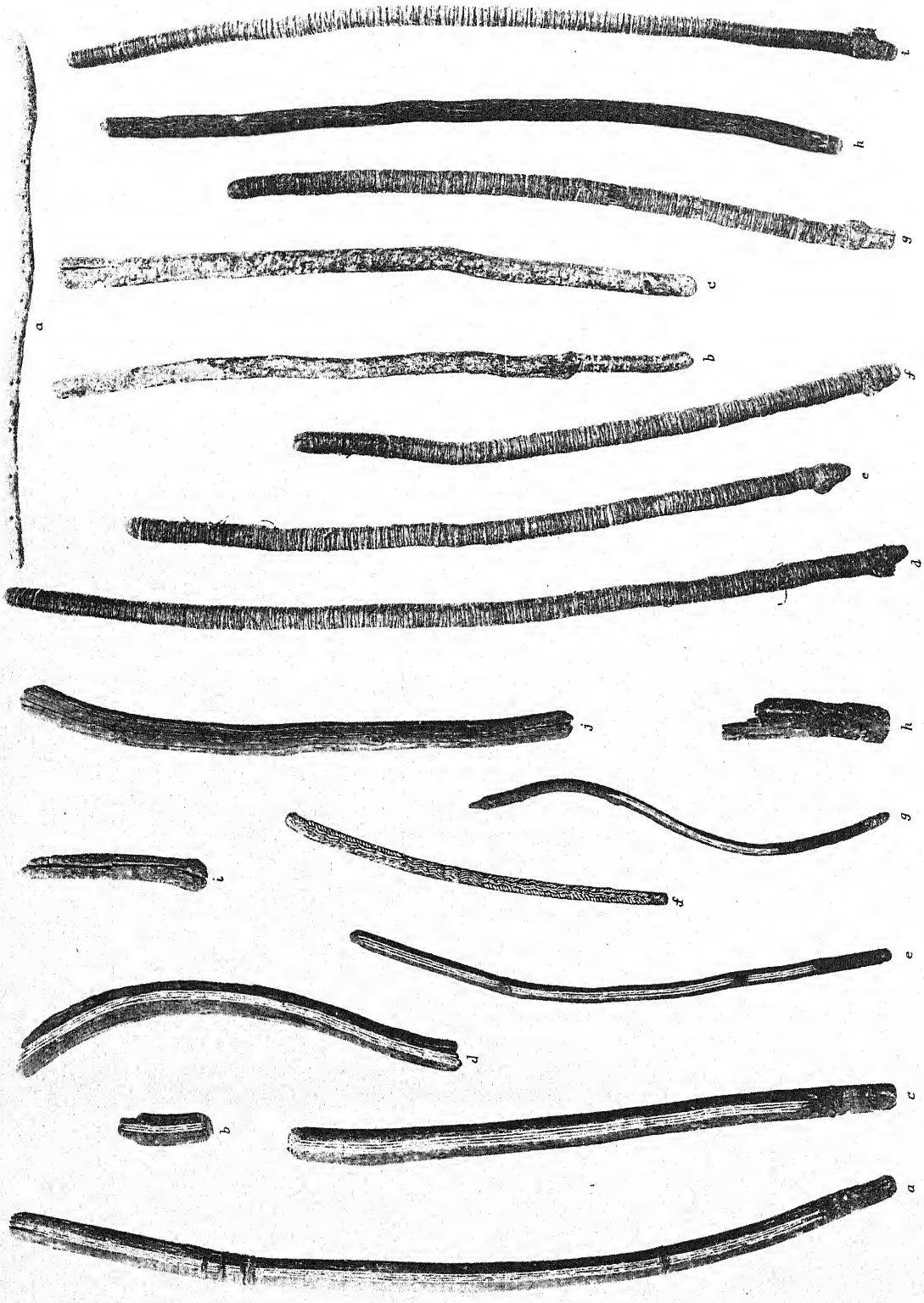
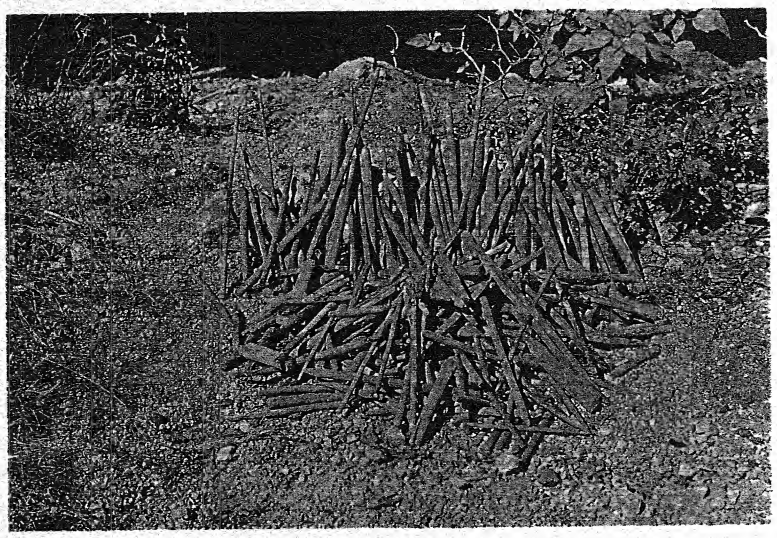


FIG. 72

FIG. 73. FENDING AND THROWING STICKS. *a-h*, Ceremonial Cave; *i, j*, Doolittle Cave. *a-d, h*, grooved fending sticks (incising whitened for clarity) (pp. 58–60); *e-g*, miniature fending sticks (p. 130); *i, j*, flattened throwing sticks (pp. 58–60).

FIG. 73. SINEW-WRAPPED AND ROUND THROWING STICKS. *a-c*, Ceremonial Cave; *d-i*, Chavez Cave. *a-c*, ordinary round throwing sticks; *d-i*, set of round sinew-wrapped fending sticks. (See pp. 60–61.) *d*, 30¾ inches long.



a

b

FIG. 74

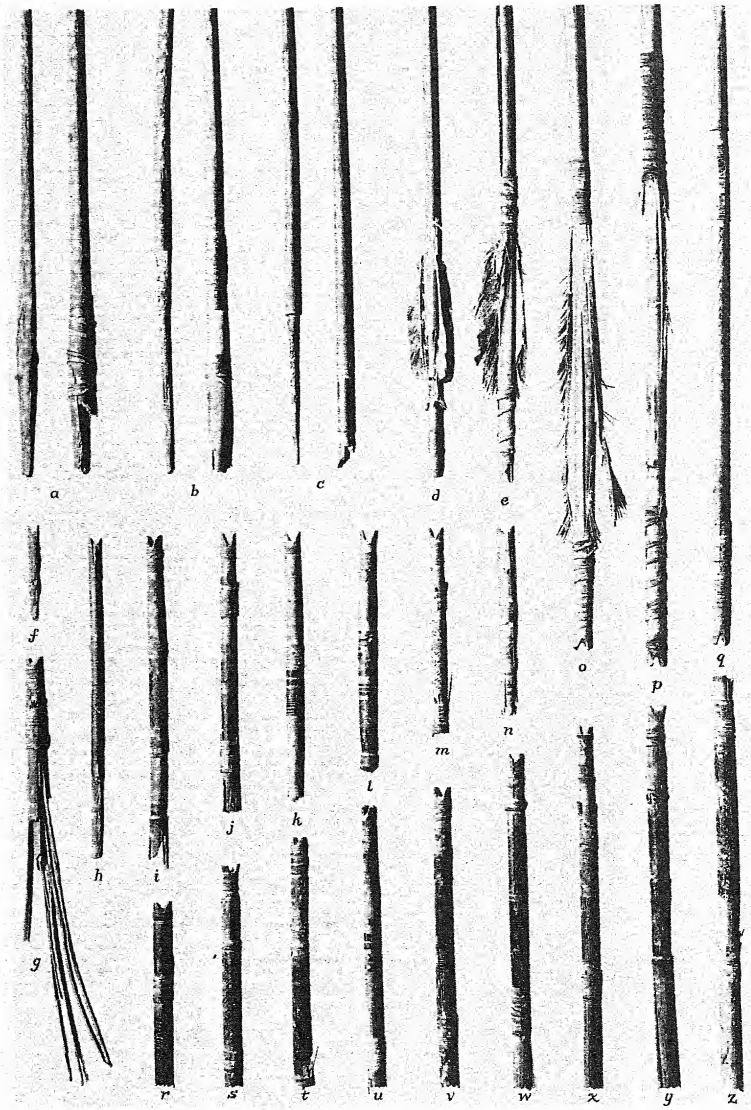


FIG. 75

FIG. 74. PAHOS AND BOWS FROM MULE CREEK CAVE. *a*, painted-stub pahos (p. 125); *b*, broken bows (p. 62).

FIG. 75. REED ARROWS. *a*, *c*, *e*, *i*, *j*, *o-r*, *x*, Mule Creek Cave; *b*, *d*, *n*, *w*, z, Cave 1, Goat Basin; *f-h*, Doolittle Cave; *k-m*, *s-v*, *y*, Steamboat Cave. *a-c*, illustrating tapering of tangs and the method in which they seat in the reed shafts; *d*, *e*, *o*, illustrations of feathering; *f*, *h*, wooden plugs; *g*, splints with sinew whipping at nock to prevent splitting of reed by bow string; *i-n*, *p-z*, nock ends. (See pp. 62–63.) *h*, 4¾ inches long.

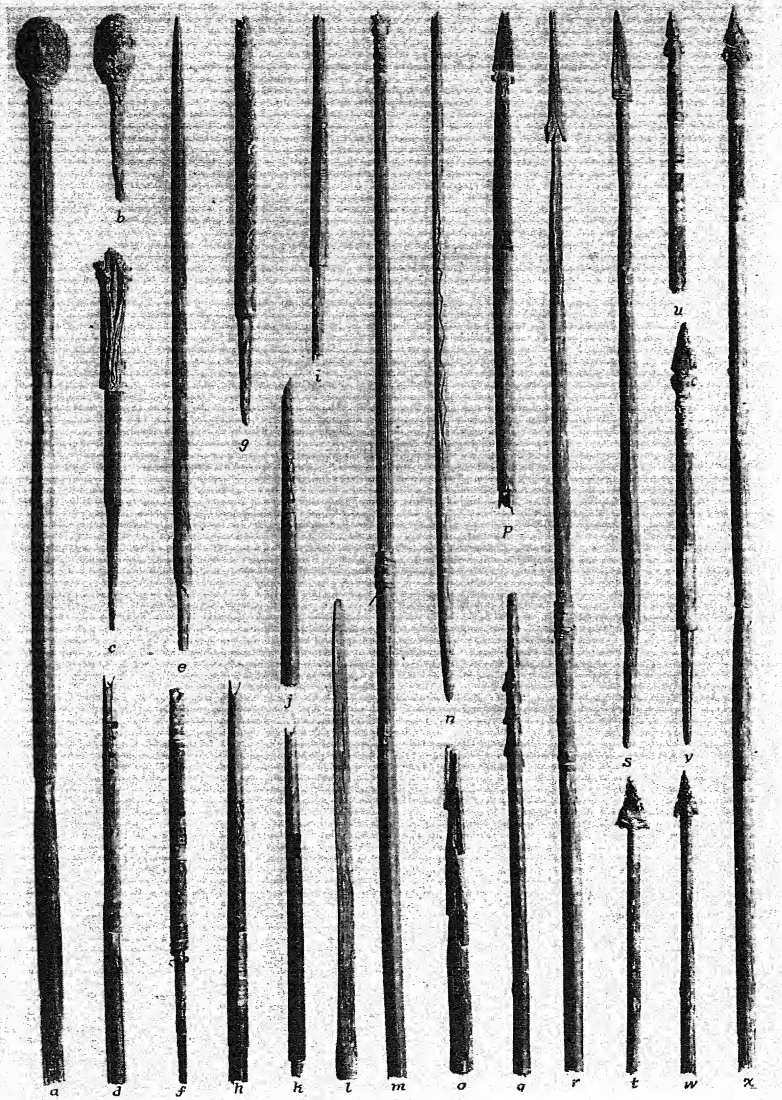


FIG. 76

FIG. 77

FIG. 76. REED ARROW FORESHAFTS WITH OBSIDIAN POINTS AND WOODEN BUNTS. *a*, *b*, Ceremonial Cave; *c*, Cave 1, Middle Fork of Gila River; *d*, *f-h*, *k*, *m*, *p*, *r*, *u-x*, Mule Creek Cave; *e*, *o*, *q*, Steamboat Cave; *i*, Water Canyon Cave; *j*, *l*, Doolittle Cave; *n*, Sipe Canyon Cave; *s*, Cave 8, Hueco Mountains; *t*, Cave 1, Goat Basin. *a-c*, arrow bunts; *d-k*, painted; *l*, squared; *m*, *n*, incised; *o*, *q*, barbed; *p*, *r*, *s*, carved ends imitating the stone points; *t-x*, with stone points. (See pp. 62–63.) *n*, 11 inches long.

FIG. 77. CORDAGE. *a*, *c*, *d*, *g*, *h*, Greenwood Cave; *b*, Chavez Cave; *e*, Mule Creek Cave; *f*, Ceremonial Cave. *a*, pottery disc, possible undrilled spindle whorl; *b*, smoothly laid yucca-fiber cord; *c*, undyed cotton and yucca-fiber cord; *d*, black-dyed yucca-fiber cord; *e*, skein of spun cotton; *f*, spindle shaft; *g*, hank of yucca fiber; *h*, grass, shredded bark, and buckskin. (See pp. 67–68.) *f*, 24¼ inches long.

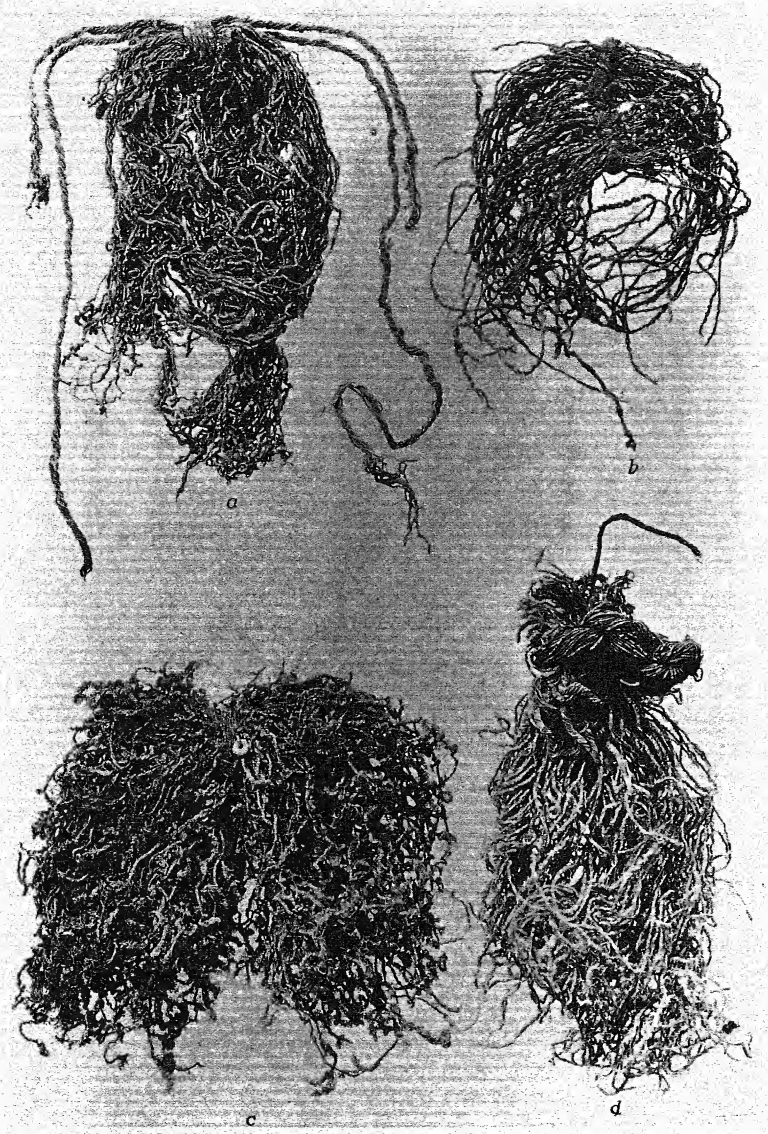


FIG. 78

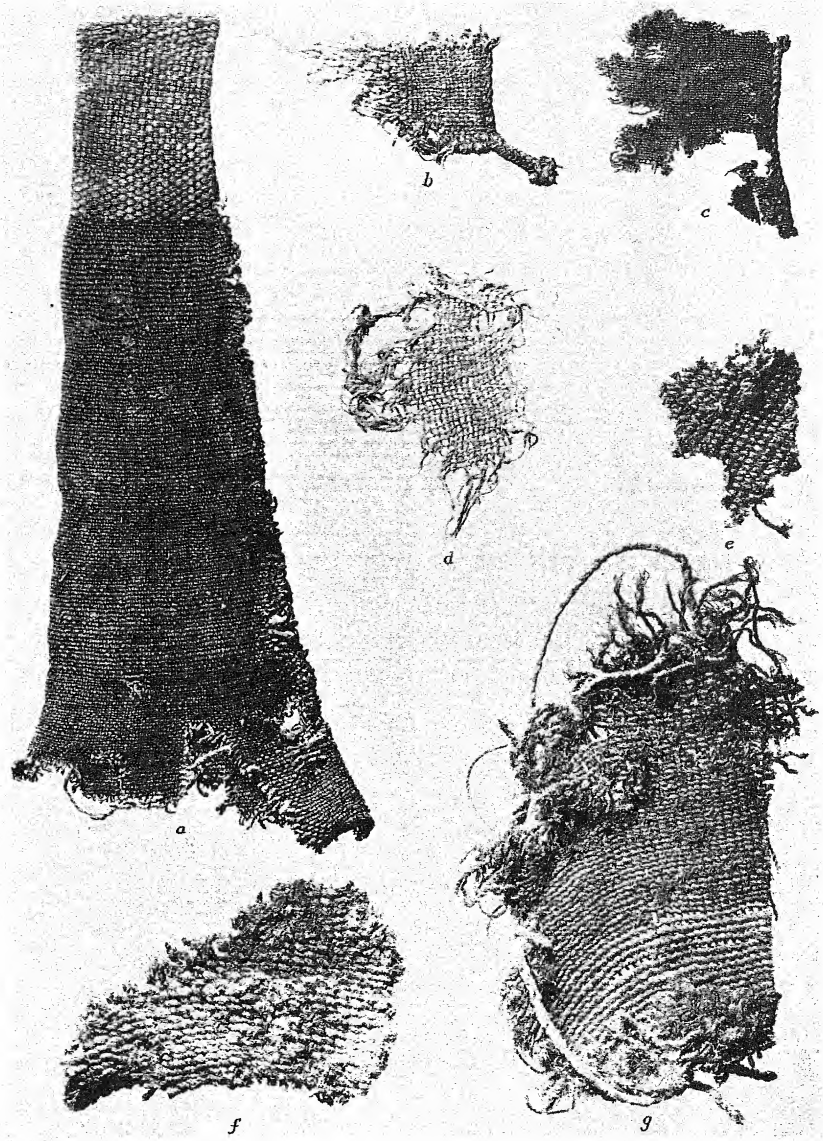


FIG. 79

FIG. 78. STRING APRONS OF YUCCA-FIBER AND COTTON CORD FROM MULE CREEK CAVE. *a*, left-spun looped single-cotton strands; *b*, 2-strand left-twist yucca-fiber cord; *c*, bundle of right-twist single-strand yucca-fiber cords; *d*, loose left-twist, 2-ply, yucca-fiber strands. (See pp. 68–69.) *d*, 11½ inches long.

FIG. 79. COTTON AND YUCCA-FIBER TEXTILES. *a*, *c*, Mule Creek Cave; *b*, Cliff House, Sapillo Canyon; *d*, Sipe Canyon Cave; *e*, Steamboat Cave; *f*, Ceremonial Cave; *g*, Kelly Cave. *a*, plain-weave cotton quiver; *b-d*, plain-weave cotton cloth; *e*, yucca-fiber coiled netting on warps; *f*, *g*, yucca-fiber twined weaving. (See pp. 69–72.) *a*, 10½ inches long.

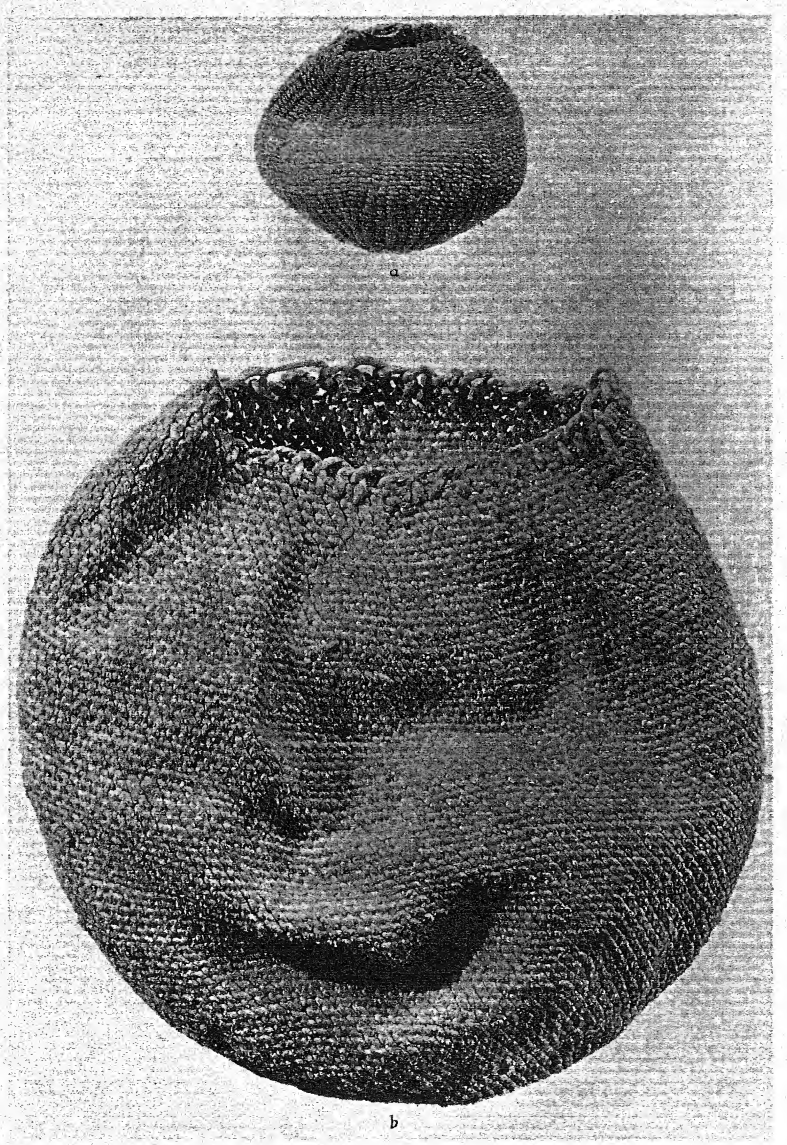


FIG. 80

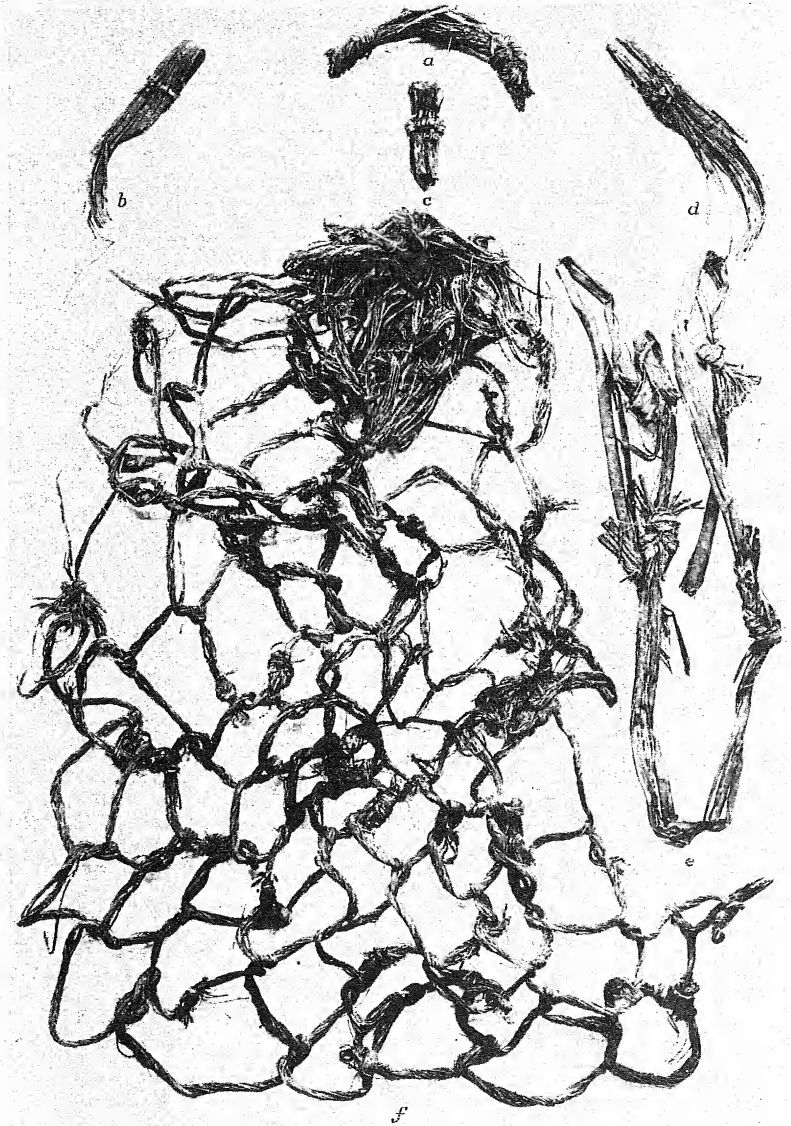


FIG. 81

FIG. 80. BAGS FROM CHAVEZ CAVE. *a*, twined-woven yucca-fiber cords (p. 70); *b*, plain coiled netting of yucca-fiber cords (p. 71). *b*, 9½ inches in diameter.

FIG. 81. BURDEN CARRIERS OF YUCCA. *a*, Cave 1, Middle Fork of Gila River; *b-d*, Ceremonial Cave; *e*, *f*, Steamboat Cave. *a-e*, heavy loops and straps; *f*, large mesh carrying net of full-turn coiled-netted weave. (See pp. 71–74.) *a*, 7½ inches long.

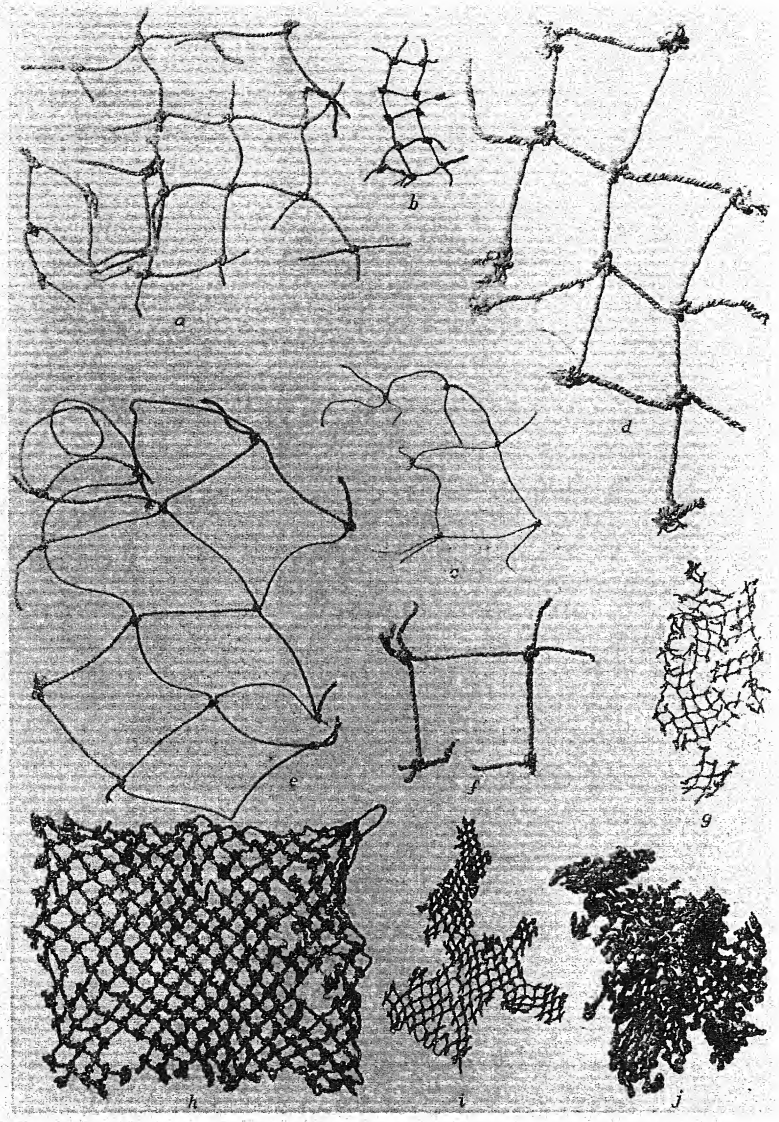


FIG. 82

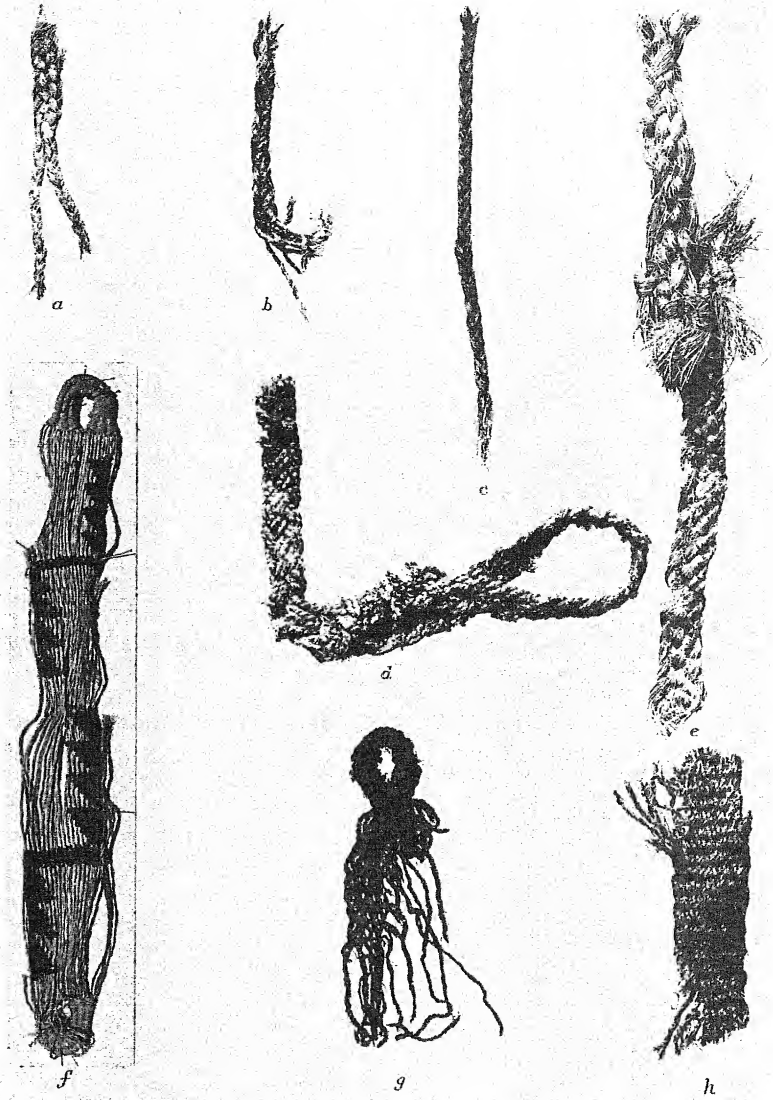


FIG. 83

FIG. 82. NETTING. *a*, *c*, *e*, *g-i*, Chavez Cave; *b*, Cave 8, Hueco Mountains; *d*, Cave 7, Hueco Mountains; *f*, Doolittle Cave; *j*, Ceremonial Cave. Illustrating size of mesh (1¼ to 2½ inches) and cordage used (3/64 to ⅛ of an inch in diameter). *a*, *d-f*, *h-j*, yucca-fiber cord; *j*, base of knotted coiled netting yucca-fiber bag; *b*, *c*, *g*, cotton. (See pp. 72–73.) *h*, 7 inches wide.

FIG. 83. NARROW FABRICS. *a*, *d*, *e*, Ceremonial Cave; *b*, *g*, *h*, Doolittle Cave; *c*, Cave 6, Hueco Mountains; *f*, Kelly Cave. *a-e*, braided bands of yucca-fiber and yucca cord; *f*, complete headband; *g*, *h*, fragments of plain-weave headbands of yucca-fiber cord. (See pp. 73–74.) *d*, 5/8 of an inch wide; *f* (not to scale), 19 inches long and 2 inches wide.

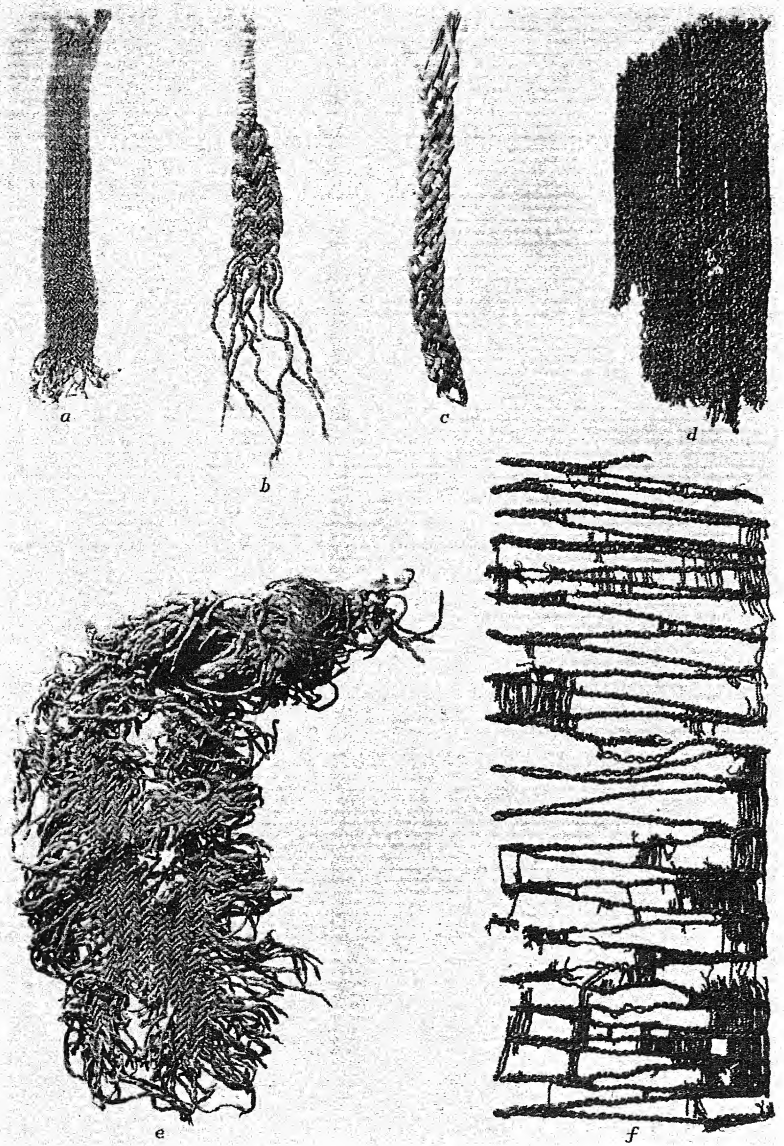


FIG. 84

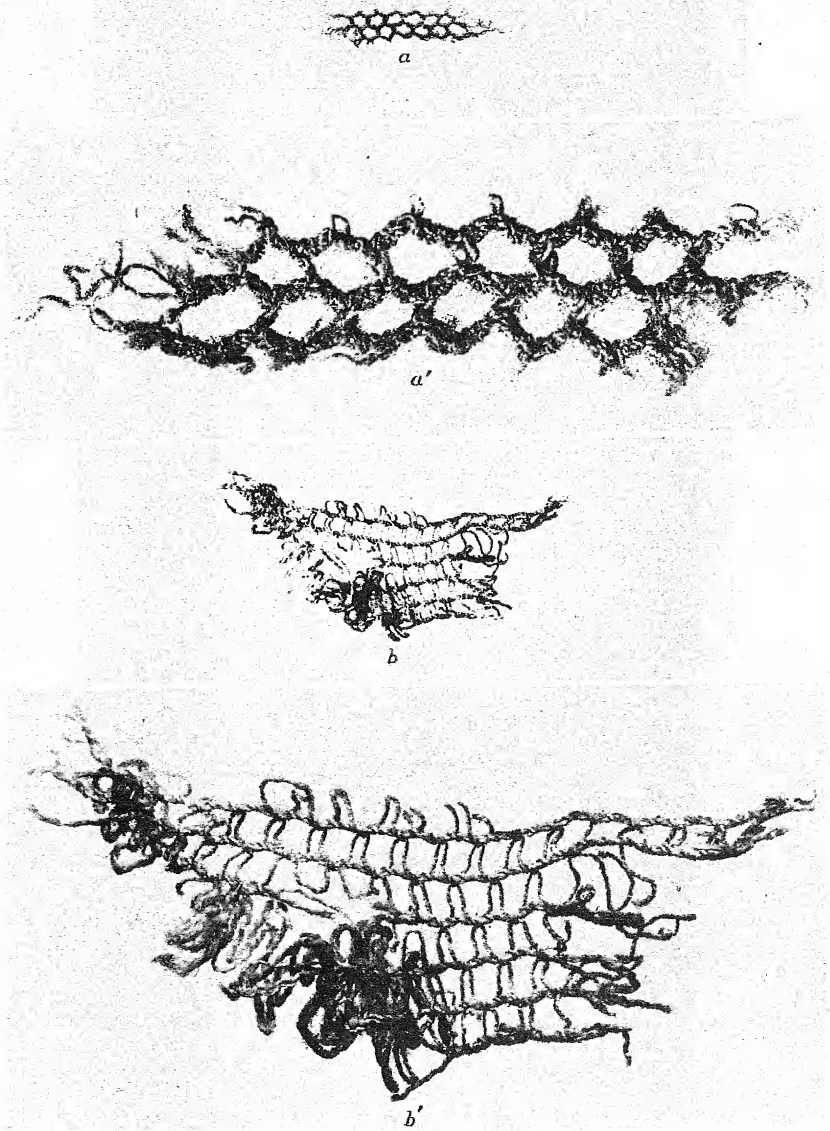
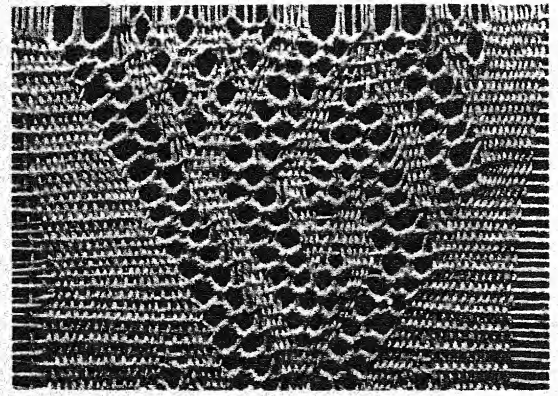


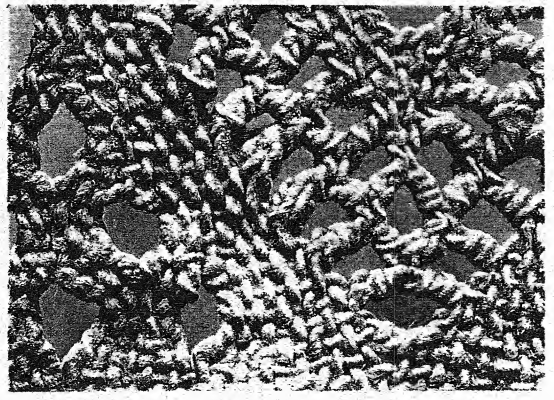
FIG. 85

FIG. 84. NARROW FABRICS. *a*, *e*, Mule Creek Cave; *b-d*, *f*, Ceremonial Cave. *a*, *e*, twilled cotton; *b*, *c*, twilled yucca fiber; *d*, yucca-cord band, spirally wrapped-warp technique; *f*, yucca-cord band, zigzag twined-weft technique. (See pp. 74–75.) *d*, 2 inches wide.

FIG. 85 COTTON LACE FROM GREENWOOD CAVE (Reproduced actual size). (See pp. 75–76.)



a



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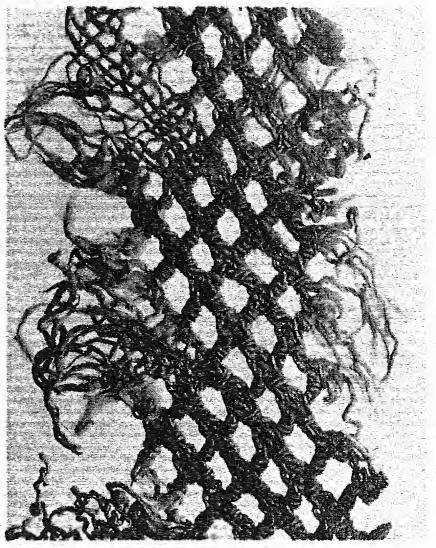
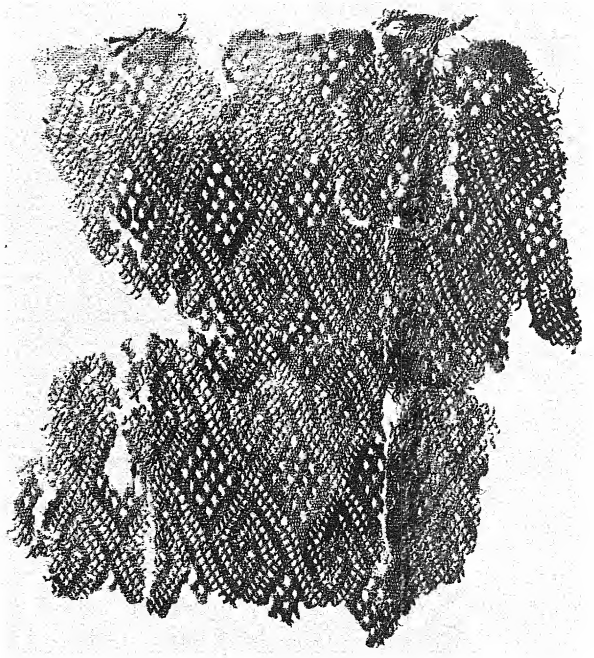
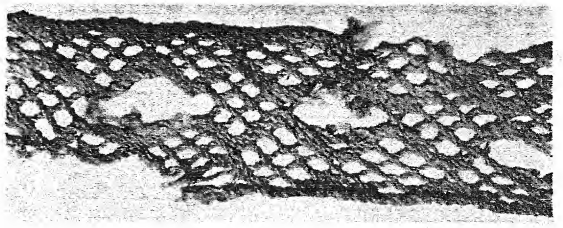


c

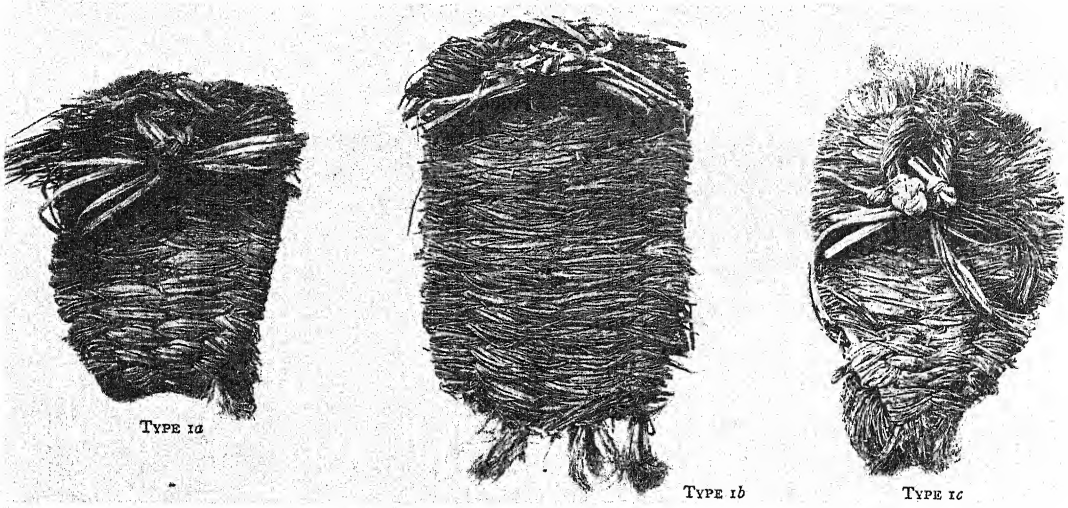


d

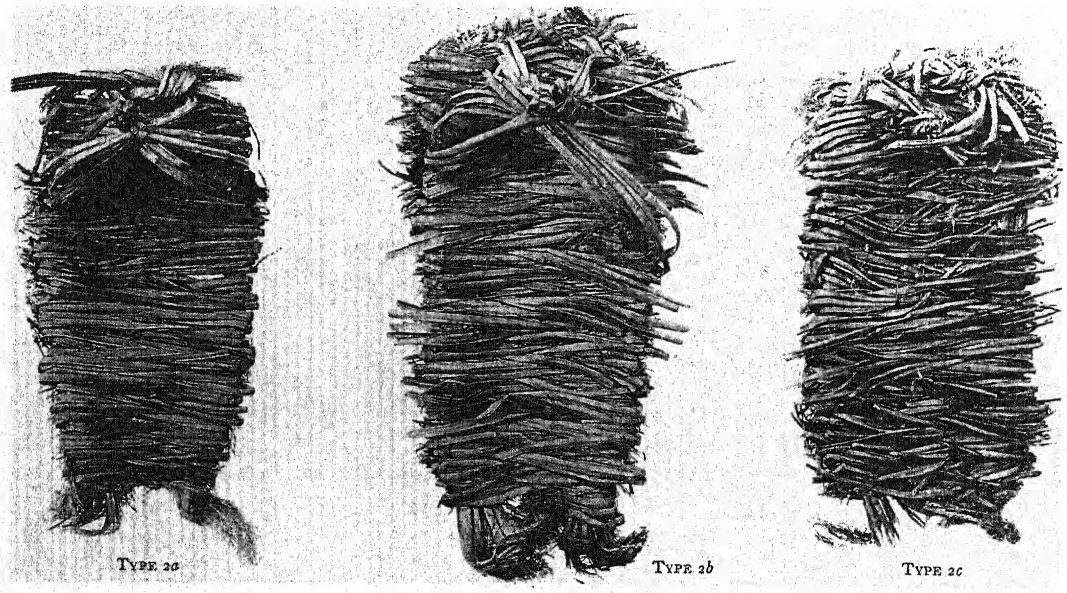


e

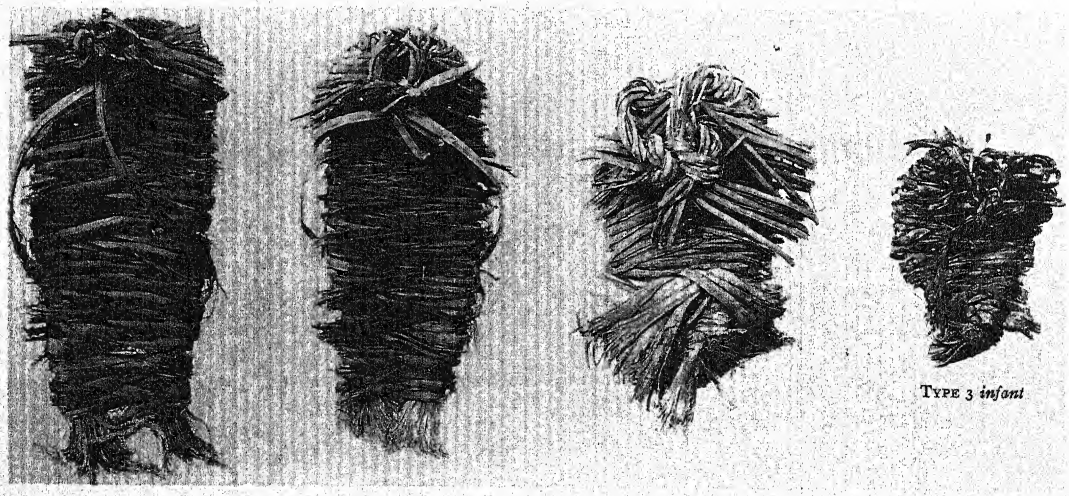
LACE AND WEFT-WRAP OPENWORK. *a*, *b*, *d*, *e*, Mule Creek Cave; *c*, Doolittle Cave.
a, a reproduction, on a larger scale, of a section of the weft-wrap openwork fabric shown in *d*; *b*, a microphotographic enlargement of a section of the same piece of textile; *c*, fragment of cotton weft-wrap openwork textile; *d*, weft-wrap openwork, an exceptional example of cotton weft-wrap openwork technique (originally textile had been sewed together in cylindrical form); *e*, lace band. (See pp. 75–79.) *c*, 1½ by 5 inches; *d*, specimen now 8 inches wide by 9 inches long; *e*, 1 inch wide.



TYPE 1, FOUR-WARP SCUFFER TOE (pp. 82–83).

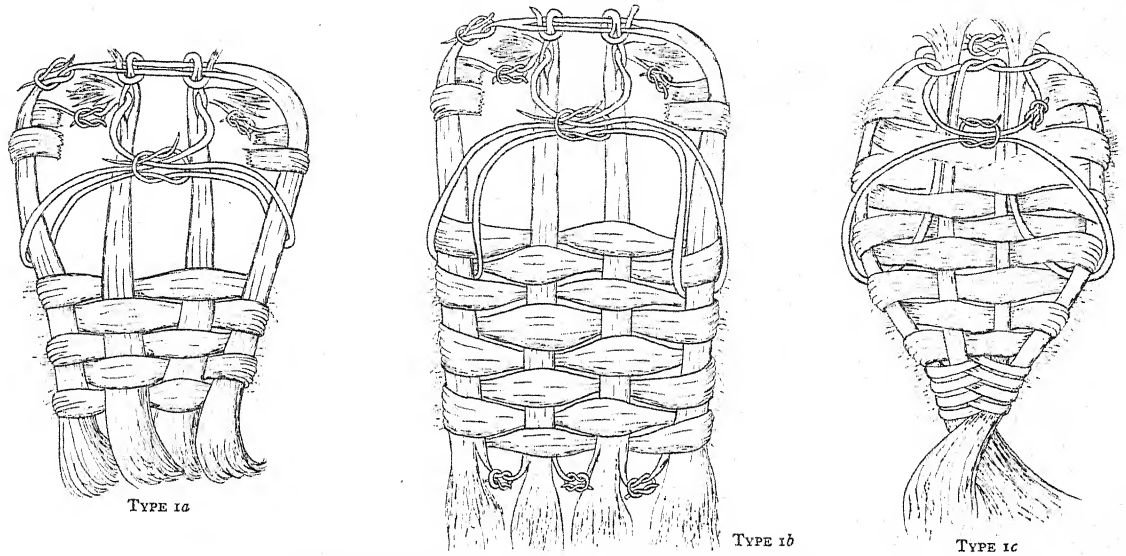


TYPE 2, TWO-WARP SCUFFER TOE (pp. 83–84).



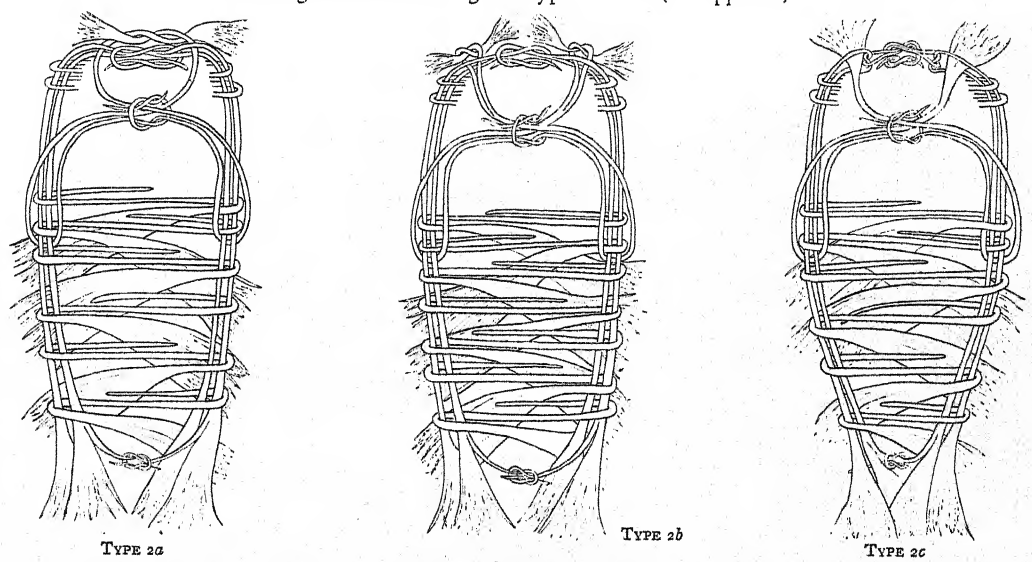
TYPE 3, TWO-WARP SCUFFER TOE (pp. 84–85).

TYPE 3: left to right, first sandal has *a* form side strap, *f* tail; second, *a* side strap, *g* tail; third, *e* side strap, *h* tail (see fig. 88); fourth, infant sandal.



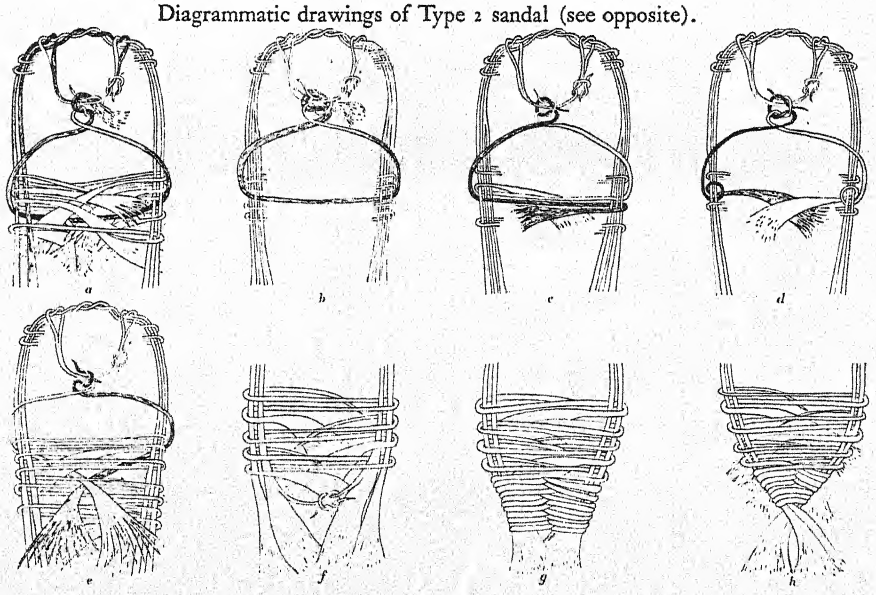
TYPE 1*a* TYPE 1*b* TYPE 1*c*

Diagrammatic drawings of Type 1 sandal (see opposite).



TYPE 2*a* TYPE 2*b* TYPE 2*c*

Diagrammatic drawings of Type 2 sandal (see opposite).

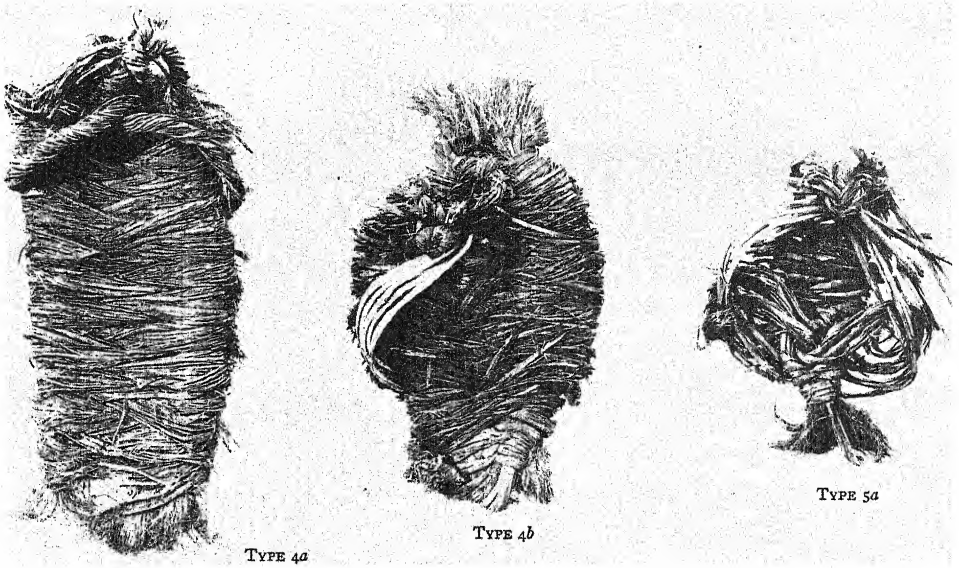


a *b* *c* *d*

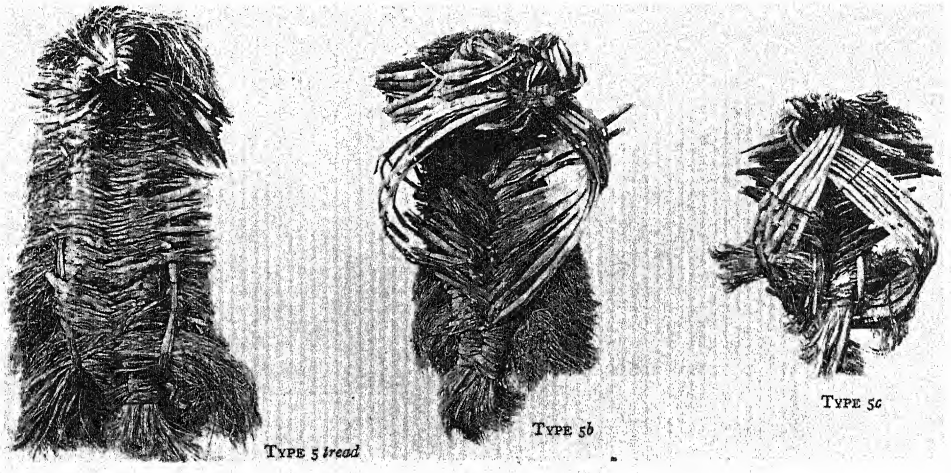
e *f* *g* *h*

Diagrammatic drawings of Type 5 sandal (see opposite).

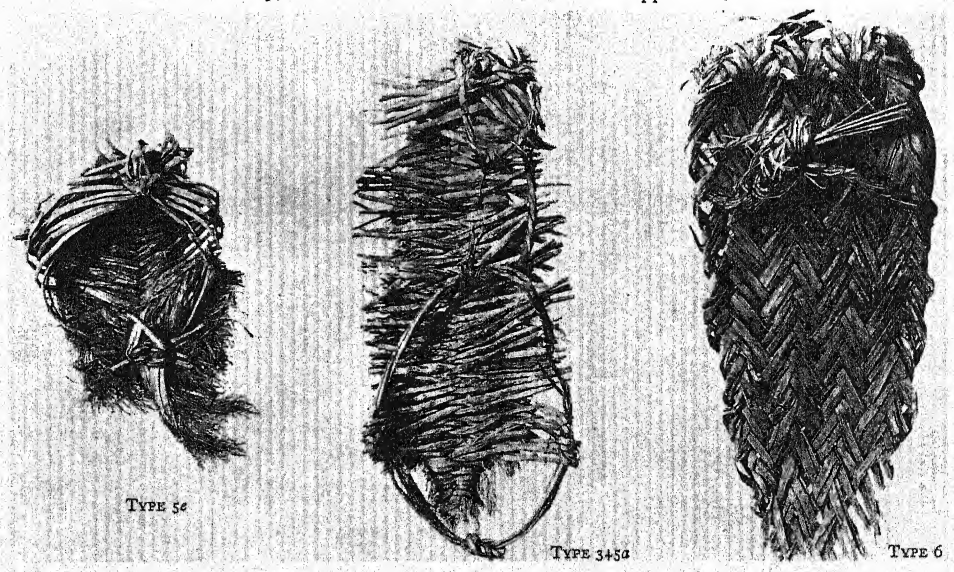
TYPE 3: *a–e*, variations in handling side straps; *f–h*, 3 forms of end finish which merge into the fish tail.



TYPES 4*a* AND 5*a*, TWO-WARP FISH-TAIL SCUFFER TOE; TYPE 4*b*, TWO-WARP FISH-TAIL TOE (pp. 85–87).

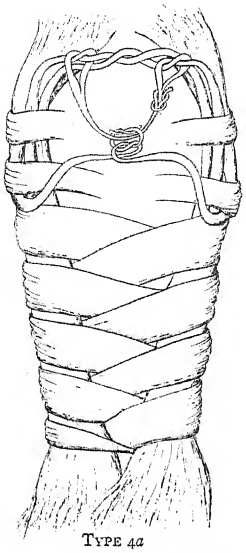


TYPE 5, TWO-WARP FISH-TAIL SCUFFER TOE (pp. 86–87).

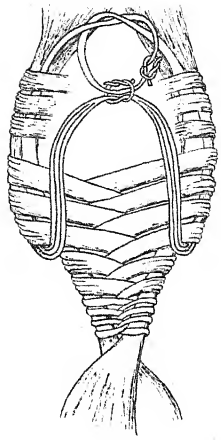


TYPE 3+5*a*, FULL-LENGTH TWO-WARP WITH HEEL LOOP, TIE STRINGS; TYPE 6, TWILLED SCUFFER TOE (pp. 87–88).

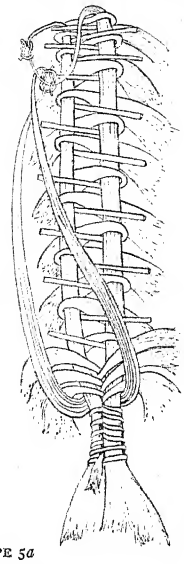
TYPE 3+5*a* illustrates the evolution in the two-warp fish-tail sandal from the scuffer toe to full length with heel ties.



TYPE 4*a*

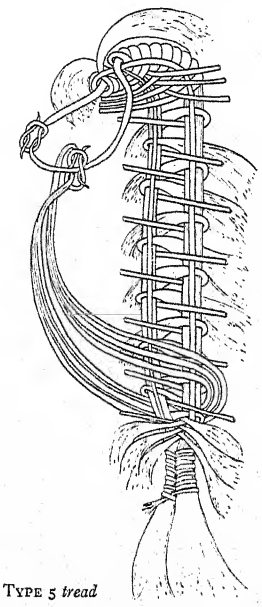


TYPE 4*b*

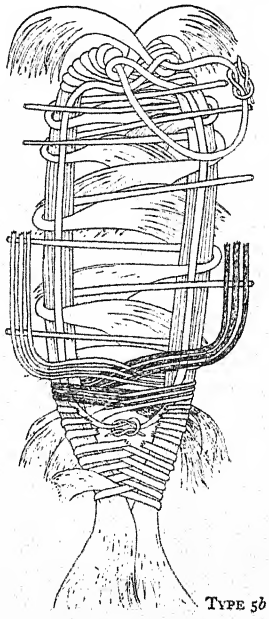


TYPE 5*a*

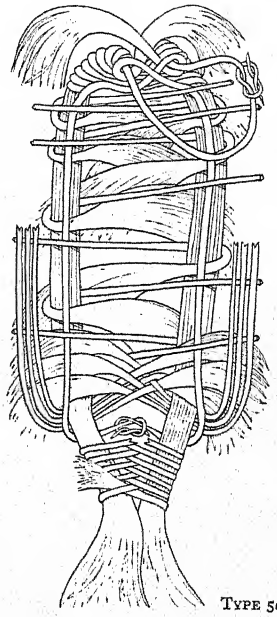
Diagrammatic drawings of Types 4*a*, 4*b*, and 5*a* sandals (see opposite).



TYPE 5 *tread*

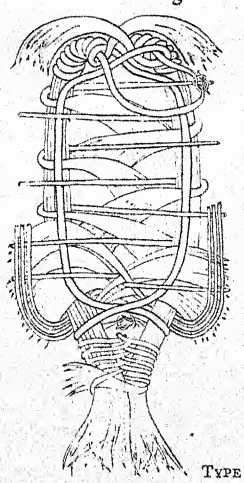


TYPE 5*b*

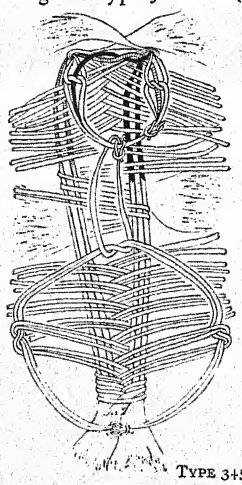


TYPE 5*c*

Diagrammatic drawings of Type 5 sandal (see opposite).



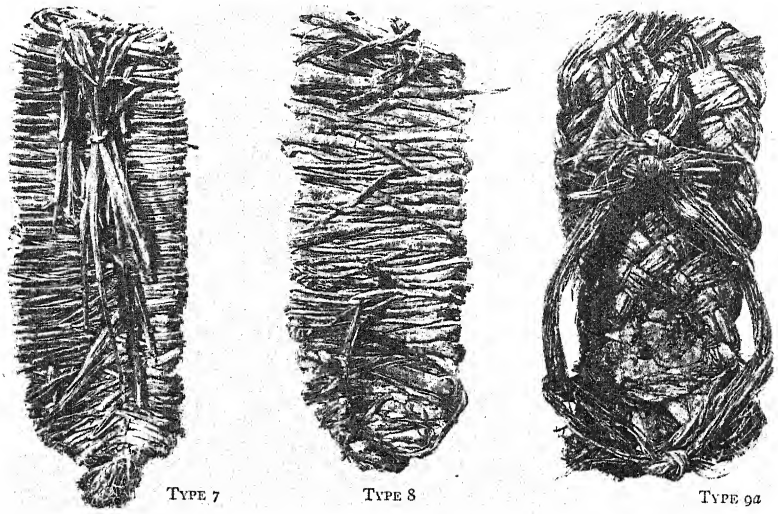
TYPE 5*e*



TYPE 3+5*a*

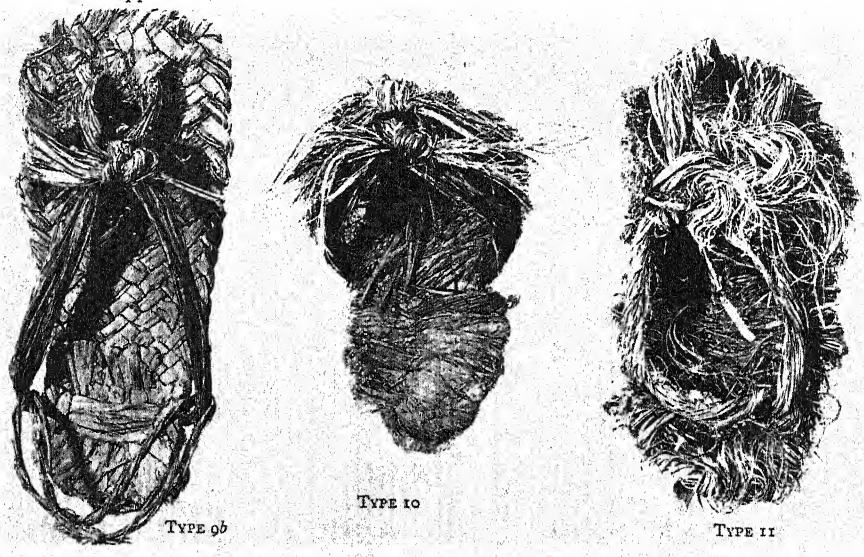
TYPE 6

Diagrammatic drawings of Types 5*e*, 3+5*a*, and 6 sandals (see opposite).
TYPE 5*e*: the crossed tension straps are exposed.



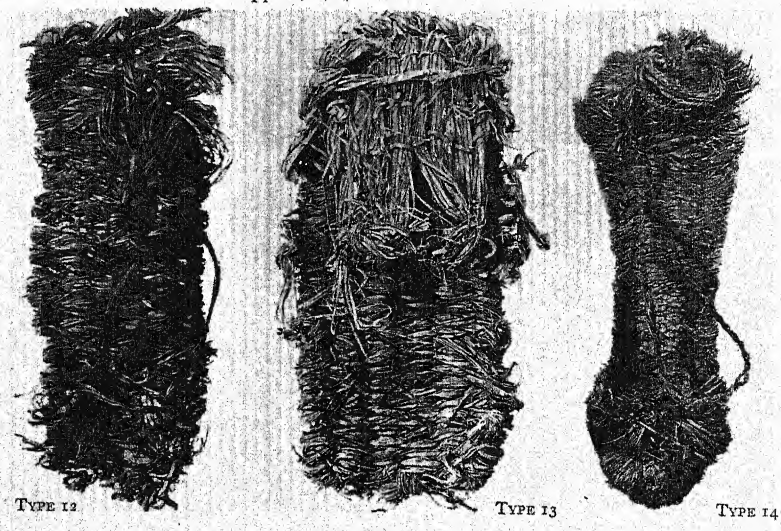
TYPE 7 TYPE 8 TYPE 9a

TYPES 7 AND 8, TWO-WARP FULL-LENGTH; TYPE 9*a*, FULL-LENGTH TURNED-HEEL (pp. 88–89).



TYPE 9b TYPE 10 TYPE 11

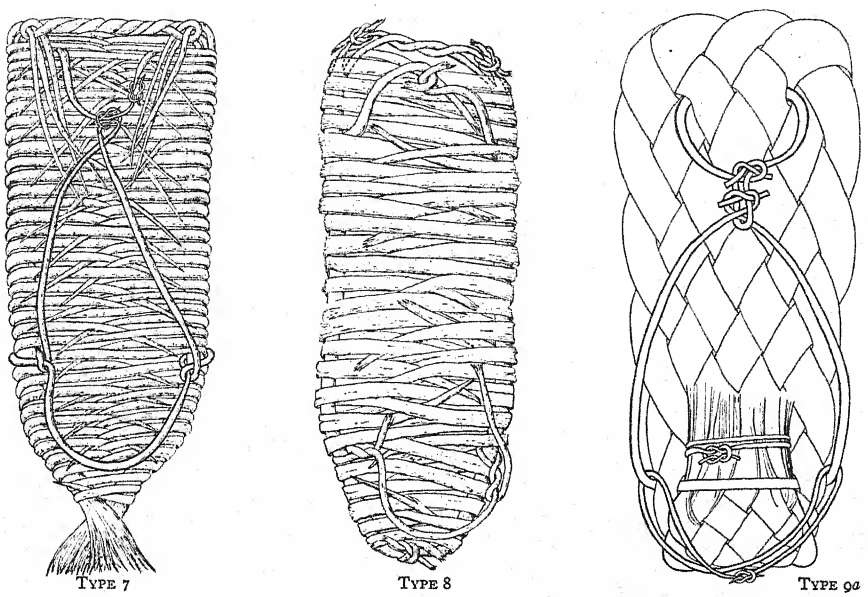
TYPE 9*b*, FULL-LENGTH TURNED-HEEL; TYPE 10, TWO-WARP SCUFFER TOE; TYPE 11, TWO-WARP FULL-LENGTH (pp. 89–90).



TYPE 12 TYPE 13 TYPE 14

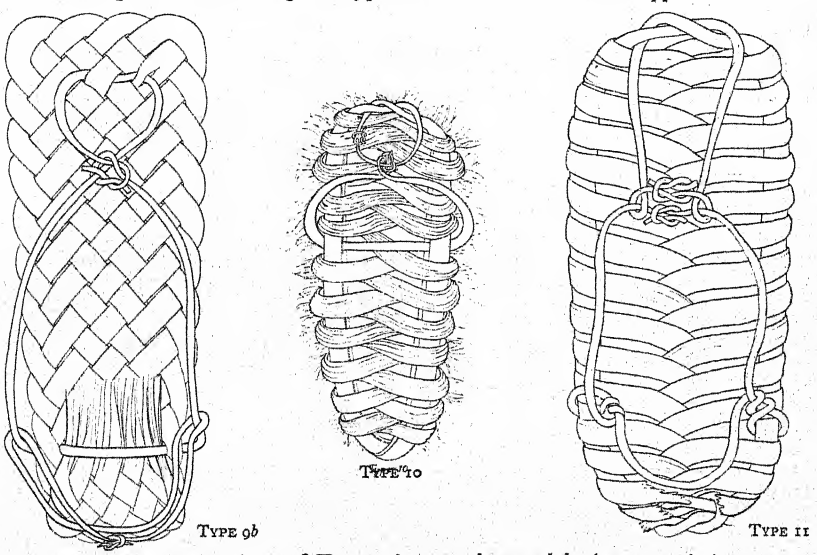
TYPE 12, FIVE-WARP FULL-LENGTH; TYPE 13, SIX-WARP FULL-LENGTH SHOE; TYPE 14, FULL-LENGTH SOFT YUCCA-STRING (pp. 90–92).

TYPE 9*b*: Pueblo form, plaited; Type 10, Upper Gila, possible variant of Hueco scuffer toe.



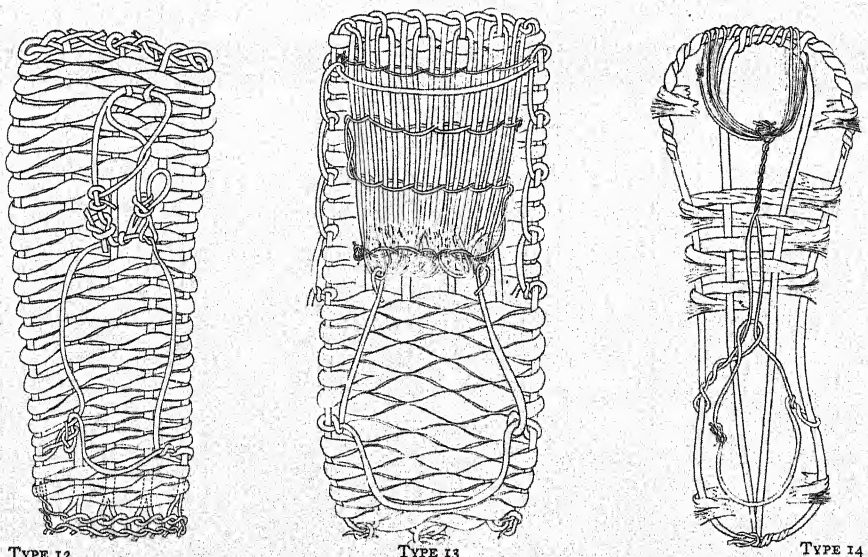
TYPE 7 TYPE 8 TYPE 9a

Diagrammatic drawings of Types 7, 8, and 9*a* sandals (see opposite).



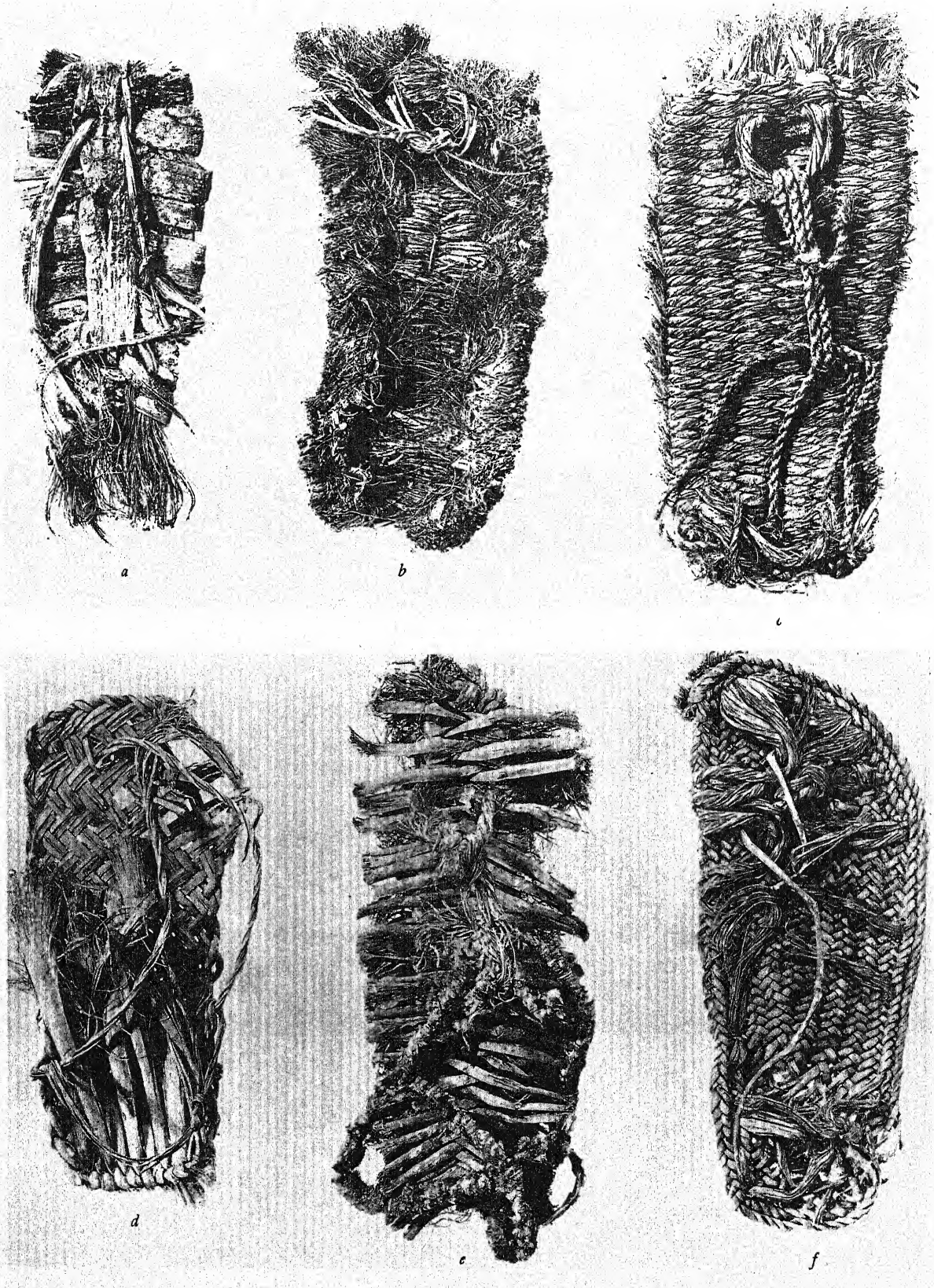
TYPE 9b TYPE 10 TYPE 11

Diagrammatic drawings of Types 9*b*, 10, and 11 sandals (see opposite).



TYPE 12 TYPE 13 TYPE 14

Diagrammatic drawings of Types 12, 13, and 14 sandals (see opposite).



COMPARISON OF THE HUECO BIG BEND BASKET-MAKER SANDALS WITH THOSE FROM OTHER AREAS. *a*, fish-tail-like sandal from Coyote Burial Cave, Coahuila, Mexico; Basket-maker II sandals from northeastern Arizona: *b*, with weaving technique similar to Type 14 sandal from Cave 6, Marsh Pass; *c*, from Broken Roof Cave, Chinlee Valley, representative of the San Juan type. Pueblo sandals from northeastern Arizona: *d*, coarse-twilled weave with turned heel from Ford House Ruin, Chinlee Valley; *e*, wickerwork weave from Cliff House 9, Chinlee Valley; *f*, fine twilling with double selvage and side loops from Poncho House, Chinlee Valley. (See pp. 97–98.)

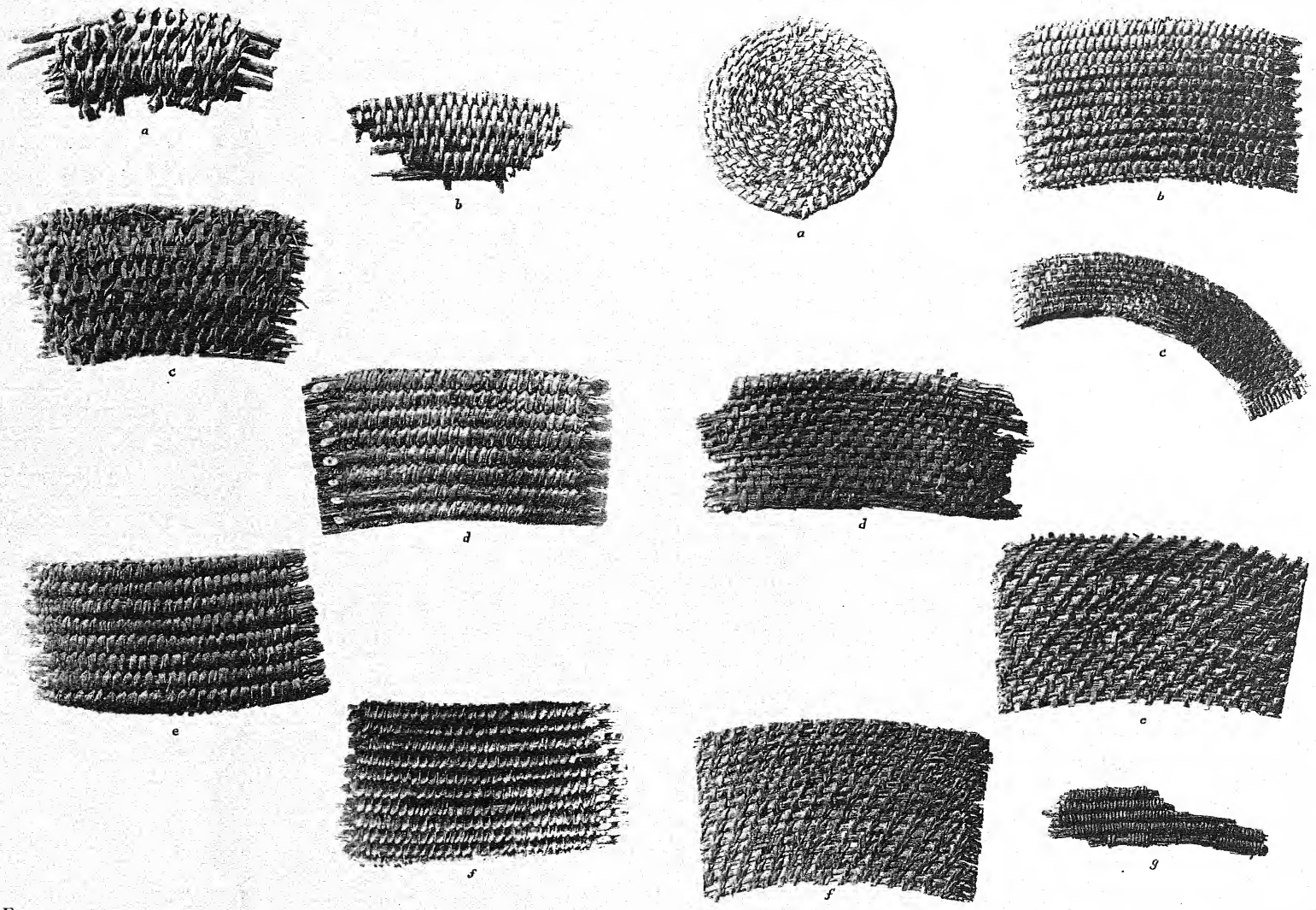


FIG. 94

FIG. 95

FIG. 94. BASKETRY TYPES. *a*, *b*, *d*, *e*, Ceremonial Cave; *c*, *f*, Chavez Cave. *a*, one-rod foundation, coarse weave, yucca sewing element, split-stitch (p. 99); *b*, one-rod foundation, fine weave, wood-splint sewing element, stitches split on side not shown (p. 99); *c*, half-rod foundation, yucca sewing element, split sitch (pp. 103–04); *d*, *e*, inner and outer surfaces of fabric with rod-with-lateral-bundle foundation, yucca sewing element, uninterlocked stitches (p. 101); *f*, two-rod-and-bundle triangular foundation, yucca sewing element, uninterlocked stitches (p. 102). *e*, 2¼ by 4½ inches.

FIG. 95. BASKETRY TYPES. *a*, *b*, *d-f*, Chavez Cave; *c*, *g*, Ceremonial Cave. *a*, *c*, bundle foundation, yucca sewing element, interlocked stiches (p. 105); *b*, Basket-maker type two-rod-and-bundle triangular foundation, wood-splint sewing element, uninterlocked stitches (p. 102); *d*, *e*, half-rod foundation, yucca sewing element, interlocked stitches (pp. 103–04); *f*, half-rod foundation, yucca sewing element, split stitches (p. 103); *g*, Pueblo type two-rod-and-bundle triangular foundation, wood-splint sewing element, uninterlocked stitches (p. 102). *a*, 3 inches in diameter.

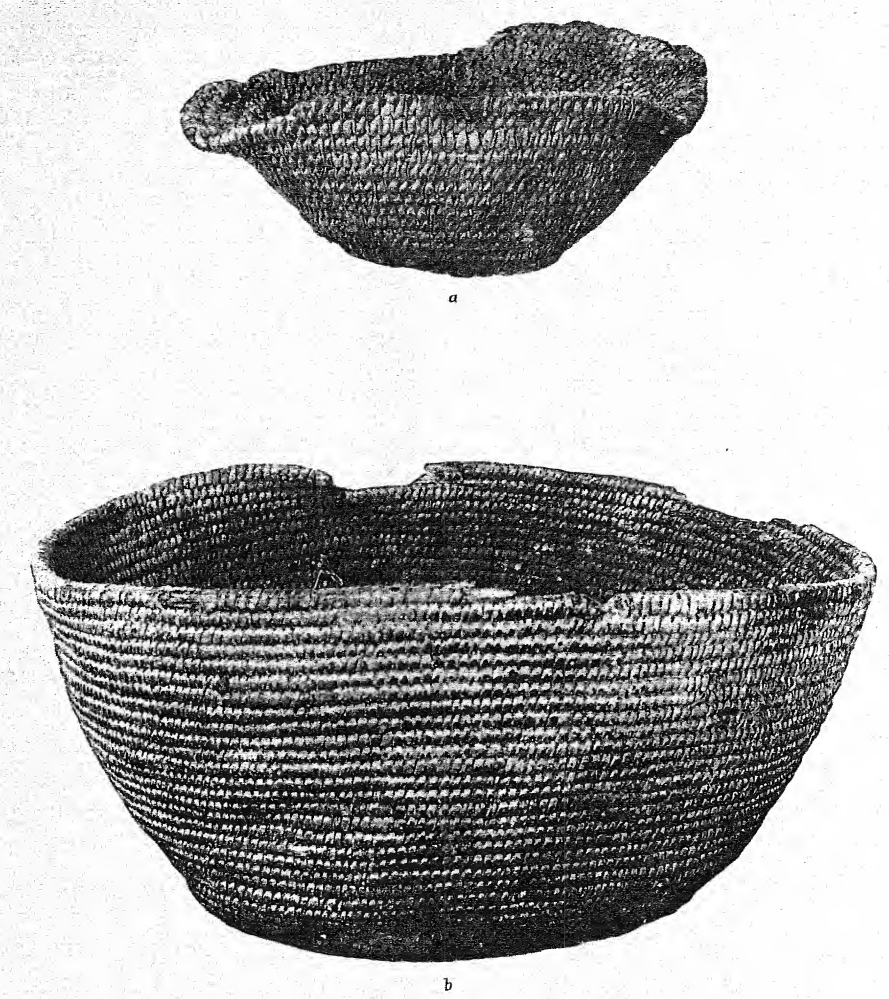


FIG. 96

FIG. 97

FIG. 96. HUECO BASKET-MAKER BASKETS FROM ADULT BURIAL IN CAVE 1, HUECO MOUNTAINS. *a*, two-rod-and-bundle triangular foundation, yucca sewing element, stitches mostly split (p. 102); *b*, bundle-with-rod-core foundation, wood-splint sewing element, uninterlocked stitches (pp. 101–02). *b*, 11½ inches diameter at rim.

FIG. 97. BASKETRY TYPES FROM THE UPPER GILA AREA. *a*, *c*, *e*, Site 6, Water Canyon Cave; *b*, Steamboat Cave; *d*, Mule Creek Cave. *a*, one-rod foundation, wood-splint sewing element sifter basket, multiple-stitch-and-wrap, interlocked (pp. 99, 101); *b*, bundle-with-rod-core foundation, wood-splint sewing element, uninterlocked stitches (pp. 101–02); *c-e*, two-rod-and-bundle triangular foundation, wood-splint sewing element, uninterlocked stitches (p. 102). *a*, 3¼ inches diameter.

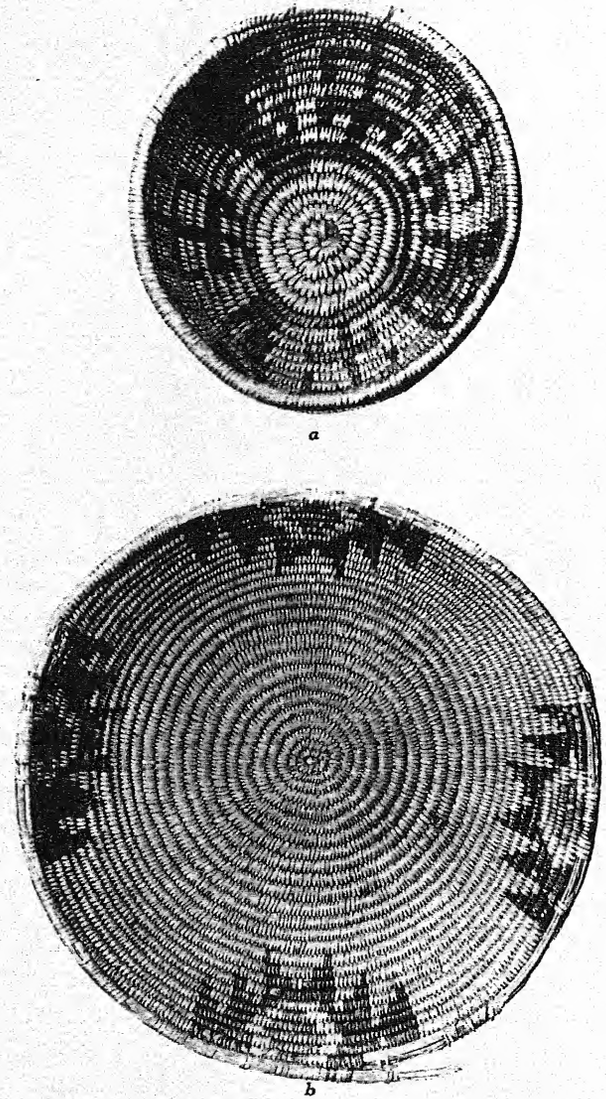


FIG. 98

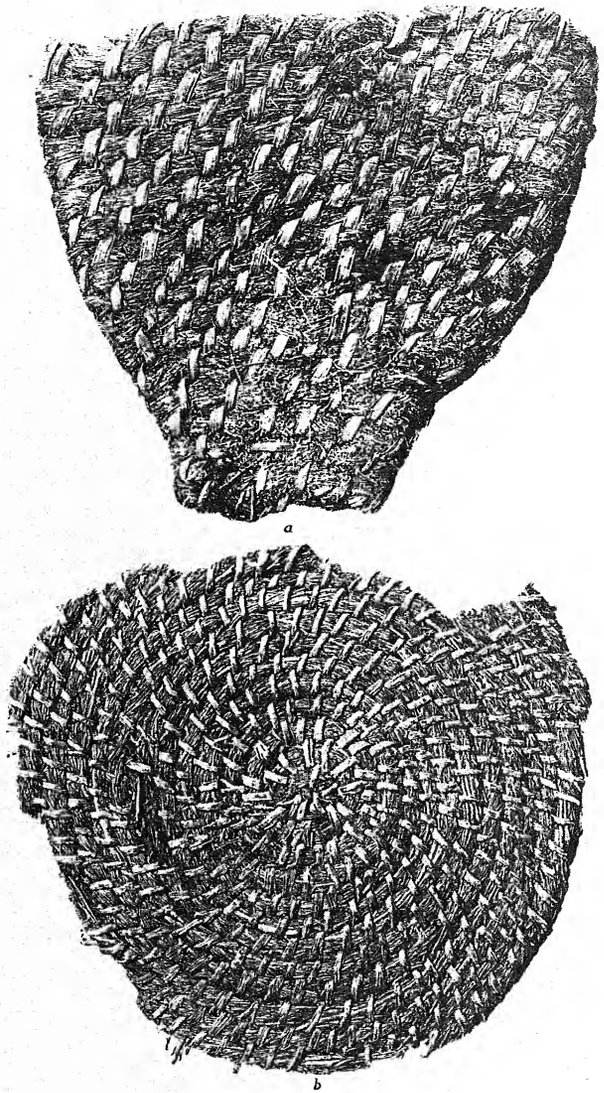


FIG. 99

FIG. 98. DECORATED BASKETS FROM SITE 2A, CAVE CANYON, MOGOLLON-SAPILLO SECTION OF THE UPPER GILA AREA. *a*, *b*, two-rod-and-bundle triangular foundation, wood-splint sewing element, uninterlocked stitches (pp. 102–03). *b*, 9 inches in diameter.

FIG. 99 COARSE COILED BASKETRY FROM THE HUECO AREA. *a*, Ceremonial Cave; *b*, Chavez Cave. Grass or fiber soft-bundle foundation, yucca sewing element, interlocked stitches (pp. 104–05). *a*, 6 inches deep.

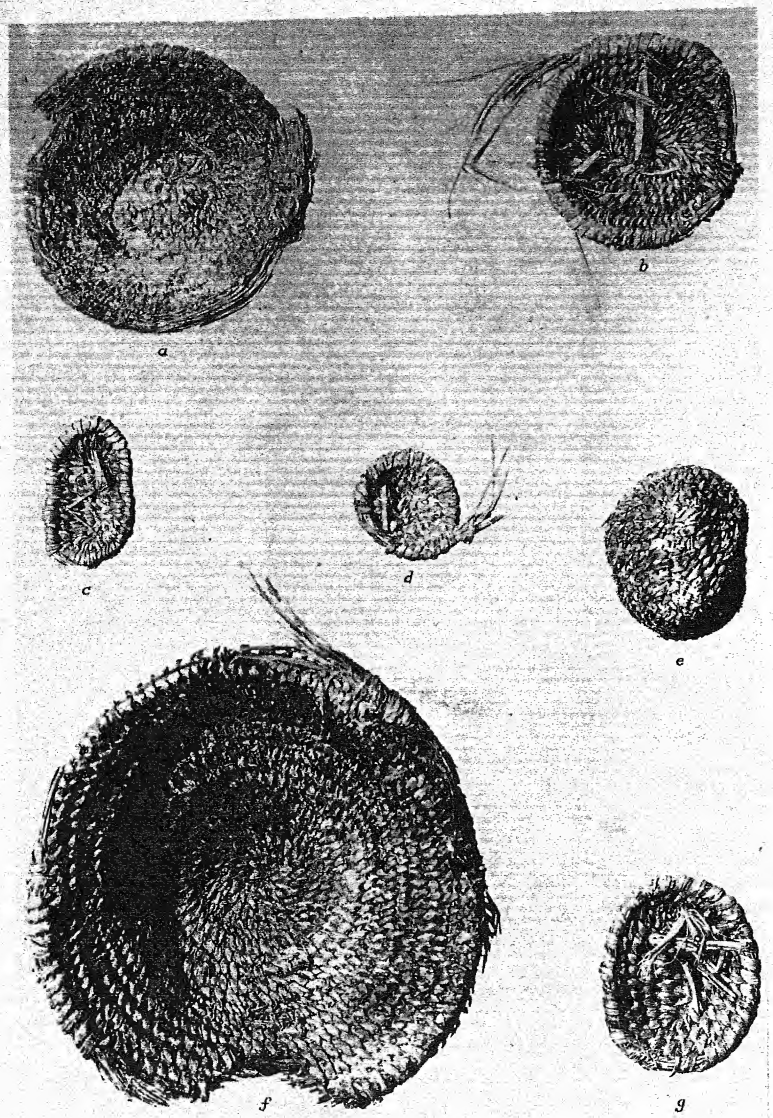


FIG. 100

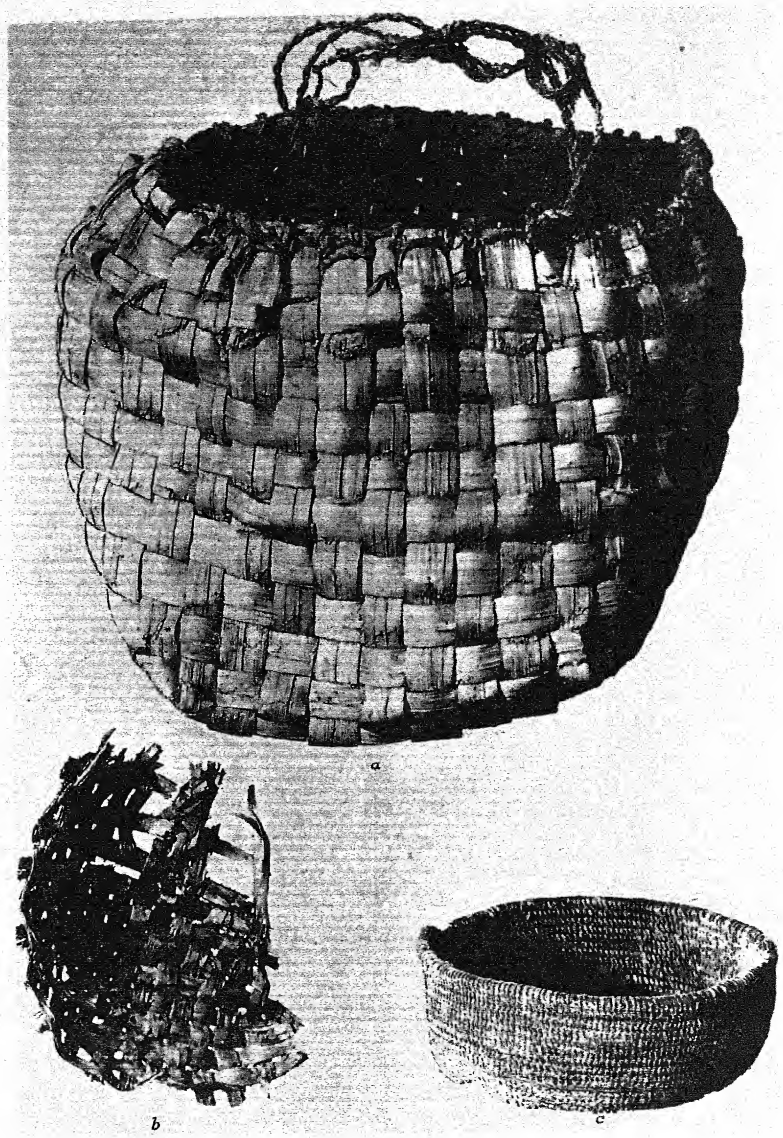


FIG. 101

FIG. 100. BUNDLE-FOUNDATION BASKETRY FROM CEREMONIAL CAVE IN THE HUECO MOUNTAINS. *a*, bundle foundation, yucca sewing element, interlocked stitches; *b-d*, *f*, *g*, bundle foundation, yucca sewing element, uninterlocked stitches; *e*, bundle foundation, yucca sewing element, split stitches. Occasional stitches of *Martynia* in rims of *b*, *c*, and *e*. (See p. 105.) *f*, 5⅛ inches in diameter.

FIG. 101. BASKETRY FROM THE HUECO MOUNTAINS. *a*, Basket-maker grave in Cave 1; *b*, Cave 6; *c*, Ceremonial Cave. *a*, *b*, plain checkerweave basket (pp. 110–11); *c*, bundle foundation, yucca sewing element, interlocked stitches (p. 105). *a*, 10 inches in diameter.

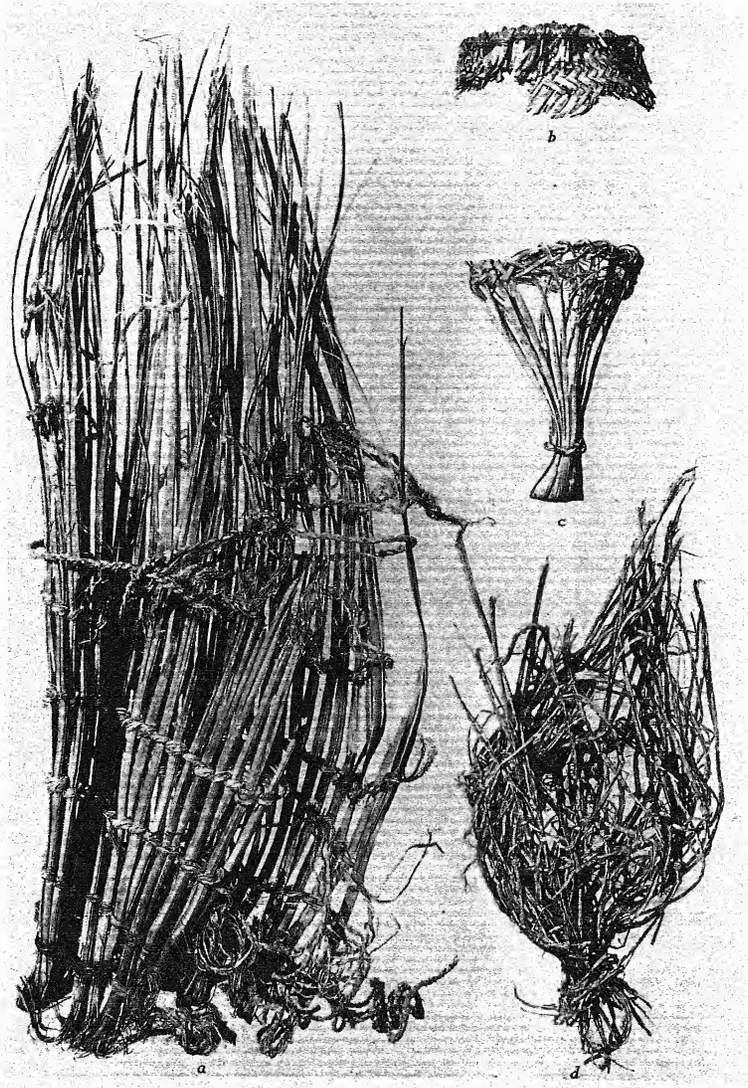


FIG. 102

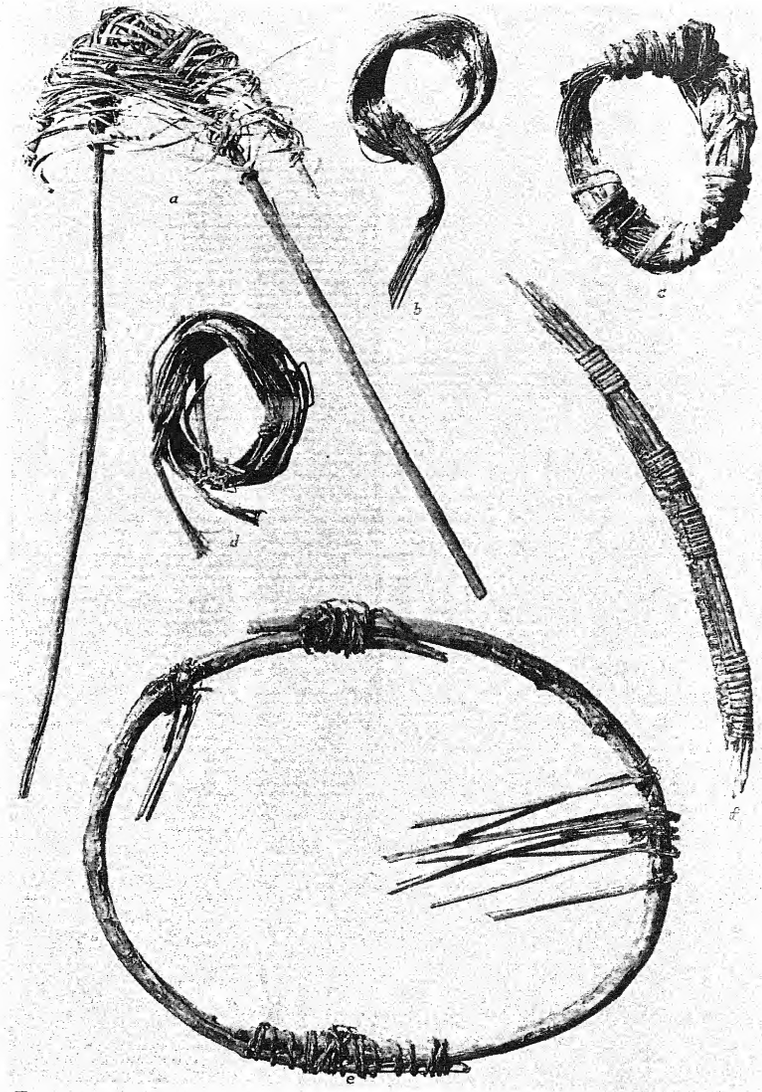


FIG. 103

FIG. 102. BASKETRY FROM THE SAN FRANCISCO RIVER DRAINAGE. *a*, *b*, *d*, Mule Creek Cave; *c*, Cave 1, Goat Basin. *a*, *d*, basket-like leaf containers (pp. 112–13); *b*, oblique twilled basket rim (pp. 111–12); *c*, leaf basket (p. 112). *a*, 21 inches long.

FIG. 103. EVIDENCE OF CERTAIN TYPES OF BASKETS IN THE HUECO AREA. *a-c*, Ceremonial Cave; *d-f*, Chavez Cave. *a*, possibly part of a miniature Mohave-type carrying basket (p. 113); *b-d*, withes for binding rod frame of carrying basket; *e*, rim of ring basket; *f*, repaired or reinforced rim from large tray basket. (See p. 113.) *e*, 7½ by 10 inches.

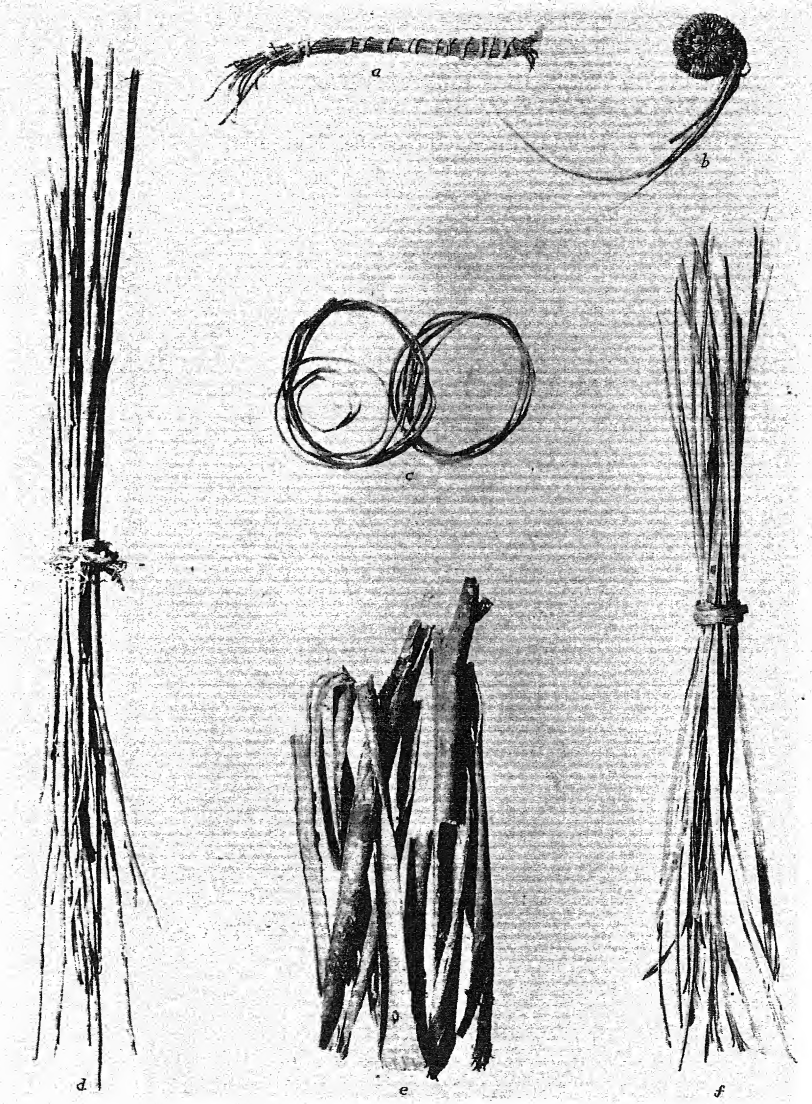


FIG. 104

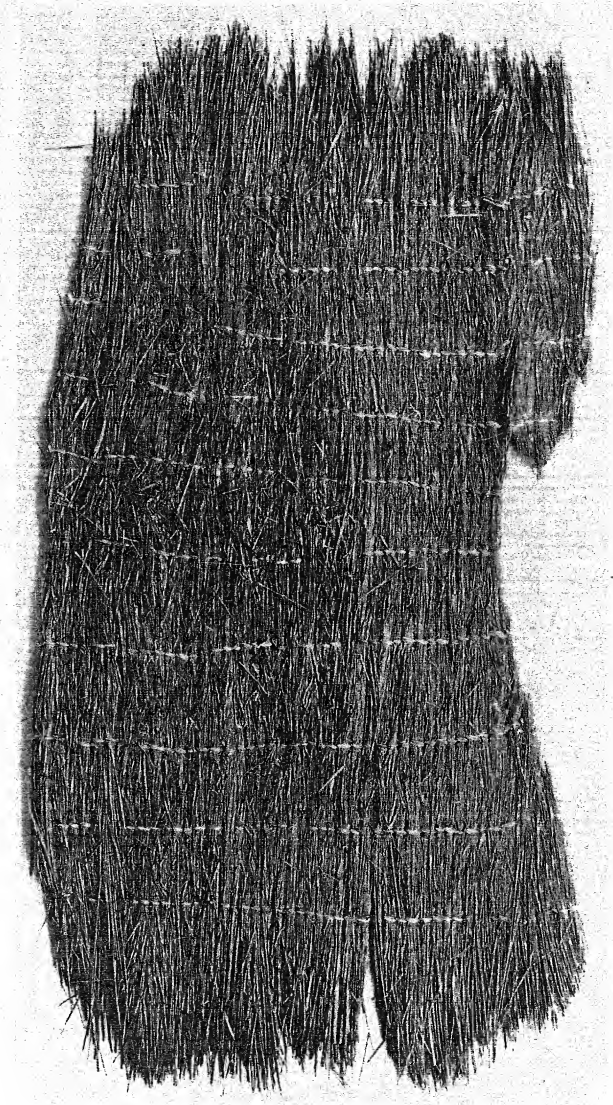


FIG. 105

FIG. 104. BASKETRY MATERIAL. *a*, Chavez Cave; *b*, Cave 7, Hueco Mountains; *c*, *e*, Kelly Cave; *d*, Cave 1, Goat Basin; *f*, Ceremonial Cave. *a*, bundle of sewing elements of split *Martynia* seed pods; *b*, *Martynia* sewing splints binding a fiber foundation; *c*, flexible wooden sewing splints; *d*, basketry rods; *e*, peeled bark for wooden sewing splints; *f*, split yucca leaves for sewing. *d*, 16¾ inches long.

FIG. 105. TIE-TWINED GRASS-BUNDLE MAT FROM CAVE 5, HUECO MOUNTAINS (pp. 113–14), 43½ inches long.

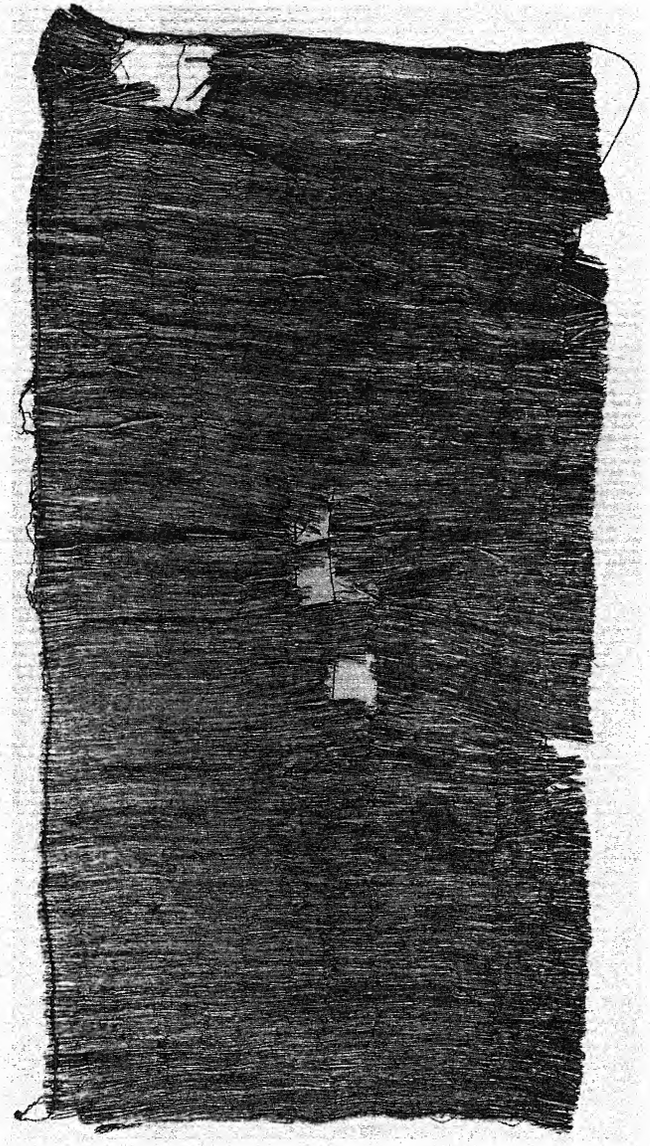


Fig. 106

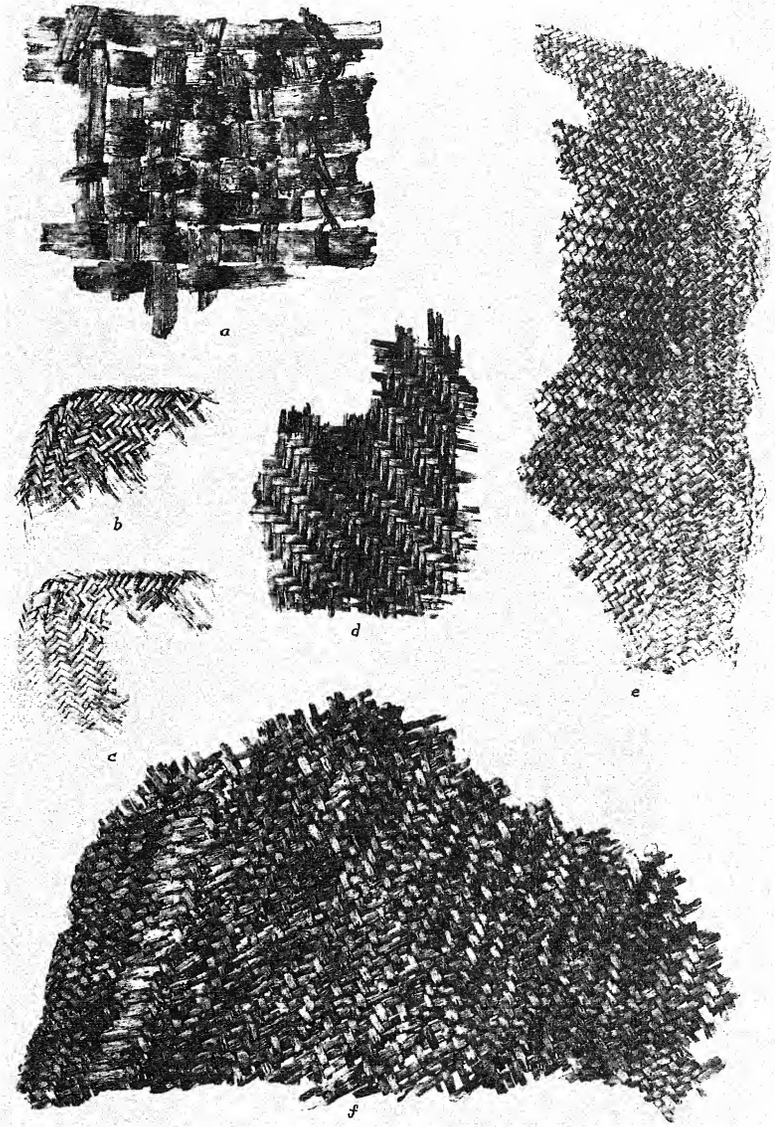


Fig. 107

Fig. 106. Threaded Rush Mat from Mule Creek Cave (p. 114), 60 inches long.

Fig. 107. Checker and Oblique Twilled Matting. *a*, Cave 6, Hueco Mountains; *b*, *c*, Cave 1, Goat Basin; *d*, Kelly Cave; *e*, Cave 9, Table Top Mountains; *f*, Mule Creek Cave. (See pp. 114–15, for *a*; pp. 115–16, for *b-f*.) *e*, 12 inches long.

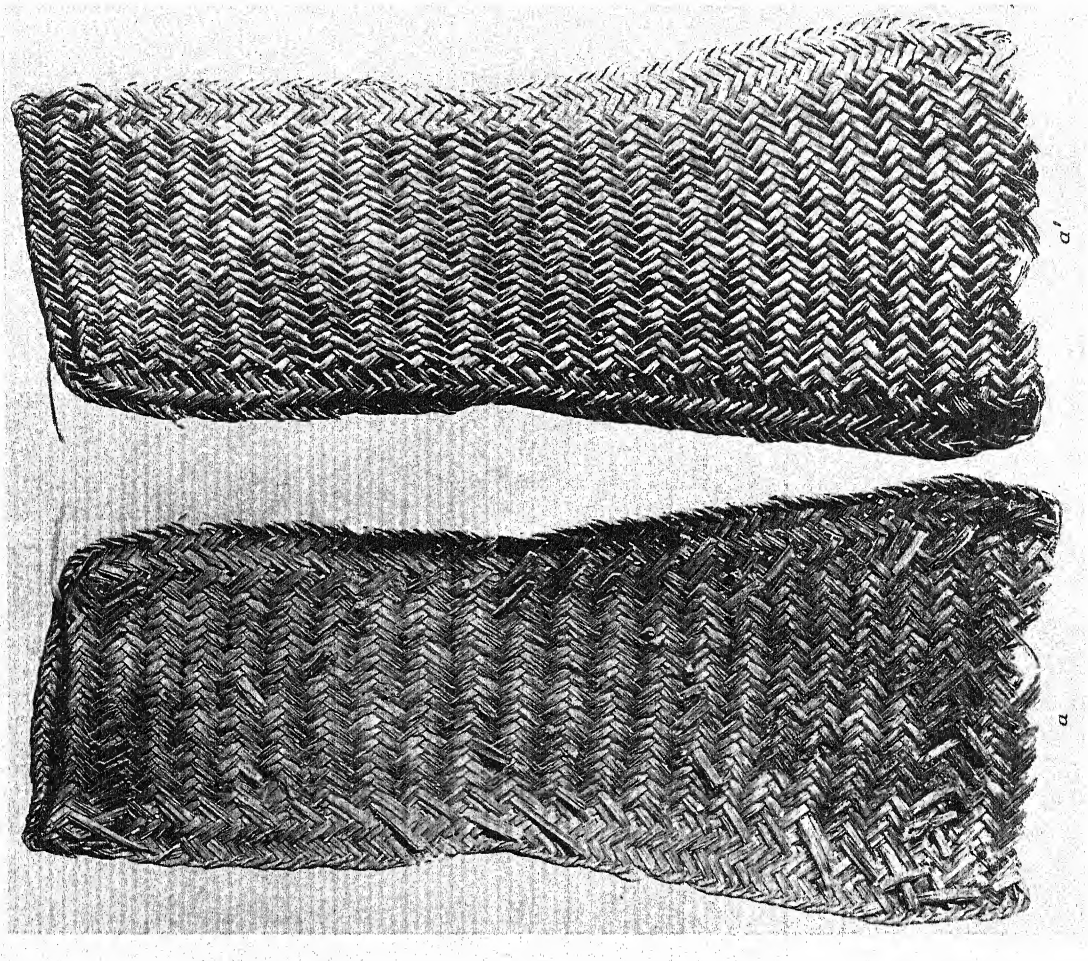


FIG. 109

FIG. 109. TWILLED CRADLE LINING FROM MULE CREEK CAVE. *a*, back; *a'*, front (pp. 116–17), 20 inches long.

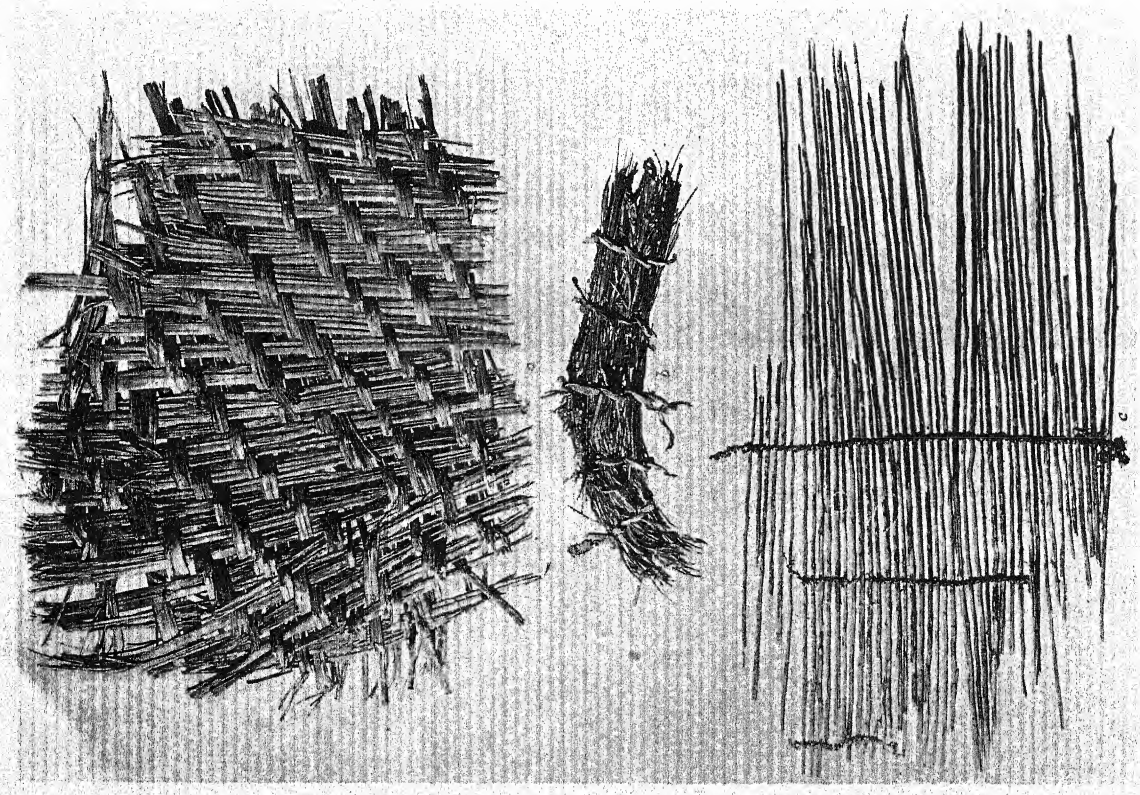


FIG. 108

FIG. 108. MATTING AND ROD CONTAINER. *a*, Cave 9, Table Top Mountains; *b*, Chavez Cave; *c*, Site 3, Cave, Gila River. *a*, oblique-twilled mat (pp. 115–16); *b*, tie-twined mat (pp. 113–14); *c*, rod container or cradle lining (p. 117). Rods in *c*, 20 inches long.

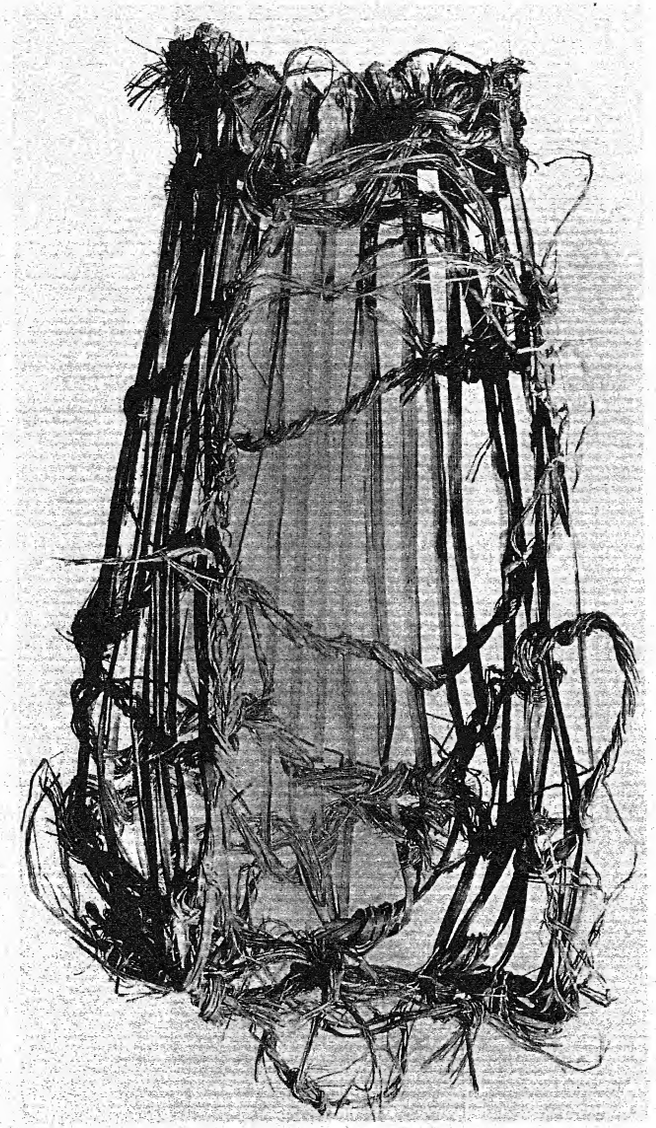


FIG. 110

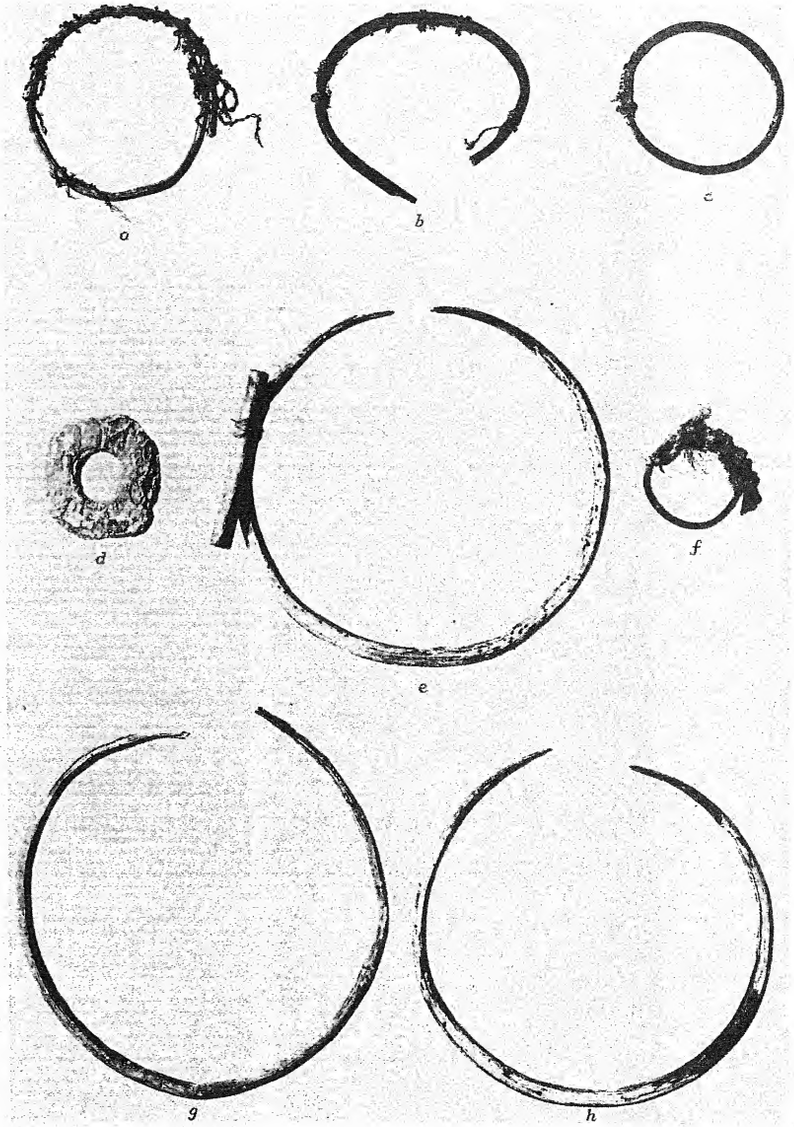


FIG. 111

FIG. 110. FLEXIBLE CRADLE FROM STEAMBOAT CAVE (pp. 117–18), 18 inches long.

FIG. 111. RINGS AND CRESCENTS. *a*, *c-e*, *g*, *h*, Steamboat Cave; *b*, Doolittle Cave; *f*, Cave 8, Hueco Mountains. *a-c*, gaming hoops; *d*, bark ring; *e*, *g*, *h*, painted crescent pahos (*e* with reed cigarette attached); *f*, ring paho. (See p. 154, for *a-d*; p. 119, for *e-h*.) *g*, 6 inches in diameter.

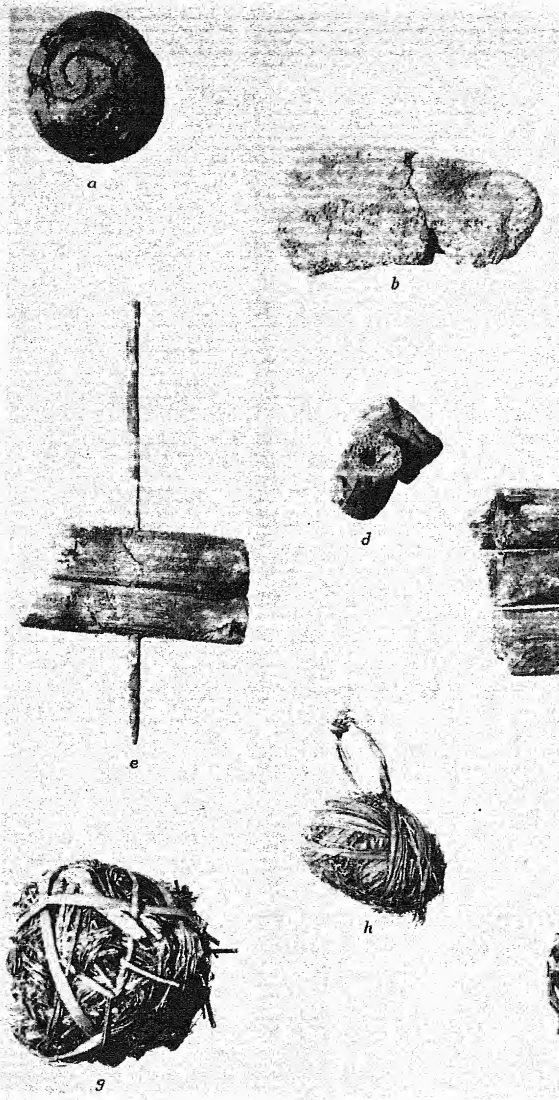


FIG. 112

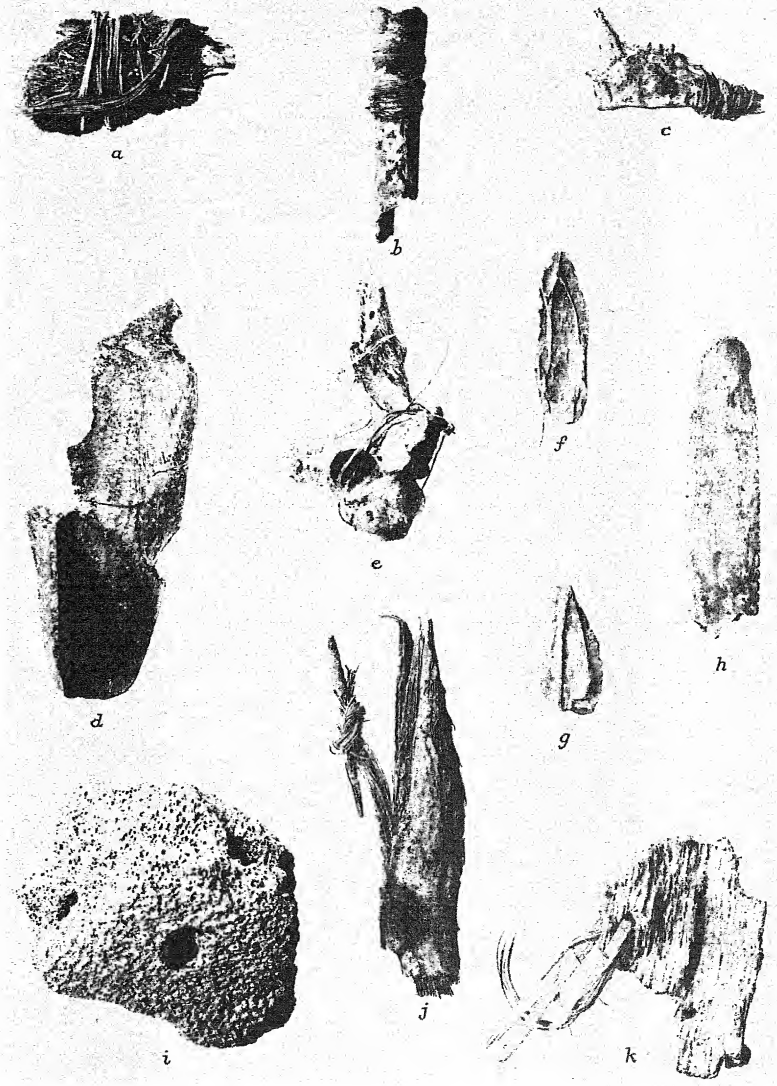


FIG. 113

FIG. 112. PITH OBJECTS AND FIBER BALLS. *a*, *e*, *f*, Mule Creek Cave; *b*, *c*, Doolittle Cave; *d*, Cave 1, Goat Basin; *g-i*, Ceremonial Cave. *a-f*, pith objects from Upper Gila area: *a*, decorated by burning, *b*, *c*, painted; *g-i*, wrapped fiber balls (use doubtful). (See p. 119.) Skewer through bars of pith at *f*, 4 inches long.

FIG. 113. BONE AND WOODEN OBJECTS. *a-c*, *j*, Ceremonial Cave; *d*, *h*, Chavez Cave; *e*, Doolittle Cave; *f*, Steamboat Cave; *g*, *k*, Cave 1, Middle Fork of Gila River; *i*, S A Canyon, Cliff House 2. Use problematical. (See pp. 119–20.) *d*, 4⅛ inches long.

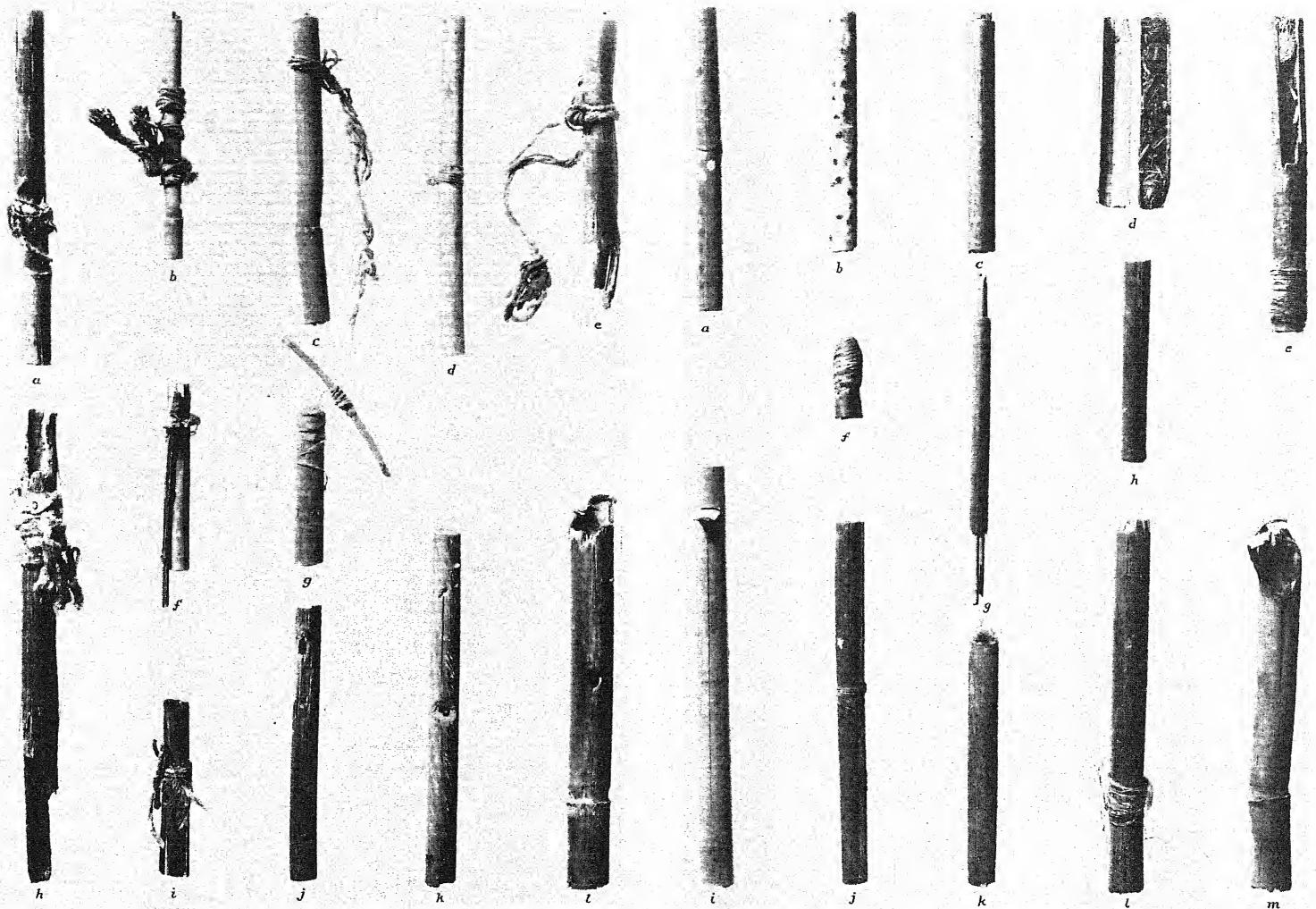


FIG. 114

FIG. 115

FIG. 114. REED CIGARETTES AND WHISTLES. *a-c*, *e*, *h*, Mule Creek Cave; *d*, *f*, *k*, *l*, Steamboat Cave; *g*, Ceremonial Cave; *i*, *j*, Doolittle Cave. Whippings on cigarettes hold feathers, beads, and small pendants; 2 cigarettes, *f*, *g*, attached to twig pahos. In the Hueco and Upper Gila areas musical instruments are absent, the reeds, *j-l*, being the nearest approach to a whistle thus far reported. *h*, 6⅛ inches long. (See pp. 120–22.)

FIG. 115. REED CIGARETTES. *a*, *j*, Doolittle Cave; *b*, *c*, *i*, *k*, *m*, Steamboat Cave; *d*, *e*, Ceremonial Cave; *f*, Chavez Cave; *g*, Saddle Mountain Cave; *l*, Mule Creek Cave; *h*, Gila National Monument. *a*, *b*, cigarettes, dotted with paint; *c*, short splints in end to take place of reed septum which is always punctured; *d*, *e*, tobacco in cigarette with fiber plugs at ends; *f*, incised; *h*, burned dots around 1 end; *j*, *l*, with bands of fiber; *k*, with feathers in end; *l*, *m*, crimped at end to hold in tobacco. (See pp. 121–22.) *i*, 5½ inches long.

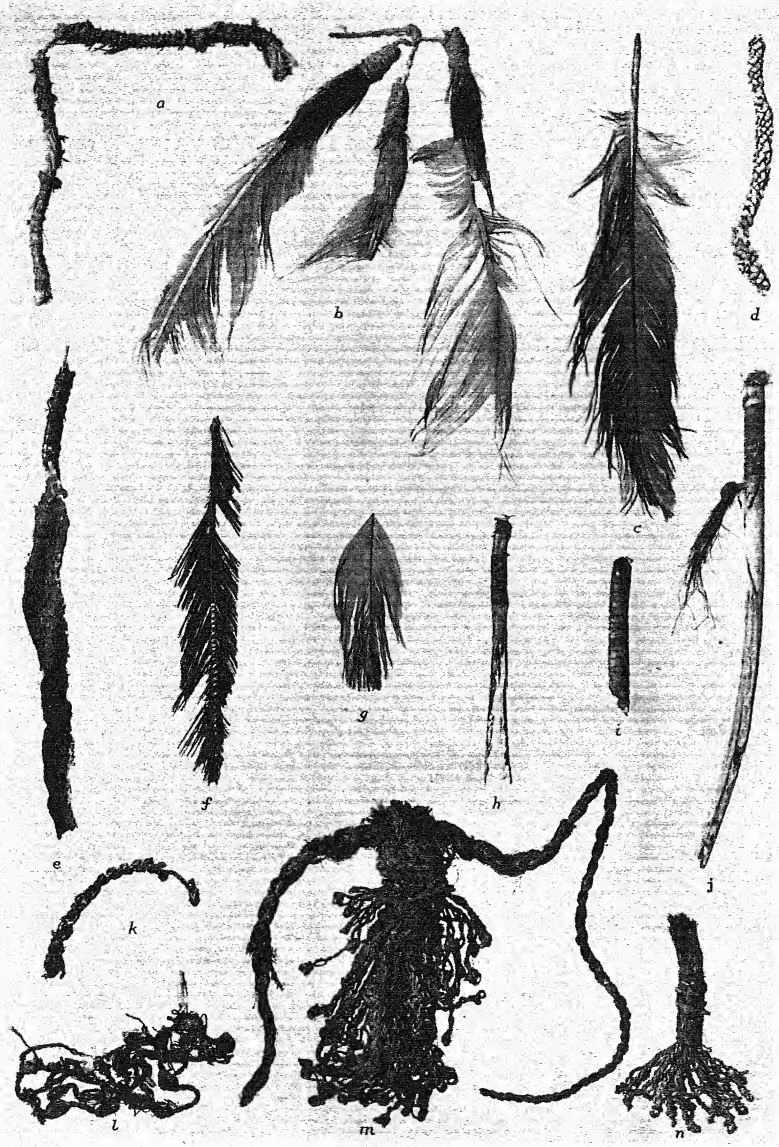


FIG. 116

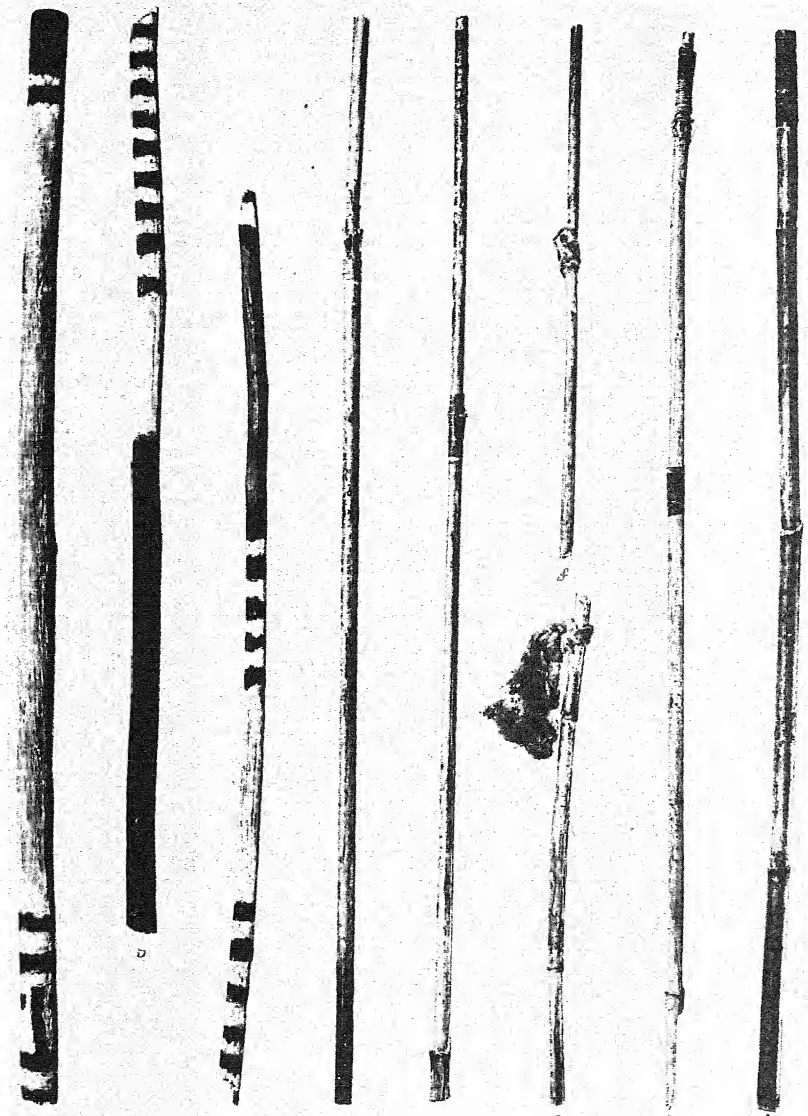


FIG. 117

FIG. 116. FEATHER ORNAMENTS. *a*, Cave 8, Hueco Mountains; *b*, *c*, *g*, Water Canyon Cave; *d*, Mule Creek Cave; *e*, *f*, *k-n*, Ceremonial Cave; *h-j*, Doolittle Cave. Illustrating attachment of feathers; *b*, *c*, *g*, red, pink, and green macaw feathers; *m*, *n*, yucca-fiber cord tassels on the ends of which feathers were fastened. (See pp. 122–24.) *c*, 6½ inches long.

FIG. 117. PAINTED TWIG GRASS-STEM PAHOS. *a-f*, *h*, Steamboat Cave; *g*, *i*, Mule Creek Cave. (See p. 124.) *a*, 9¾ inches long.

FIG. 118

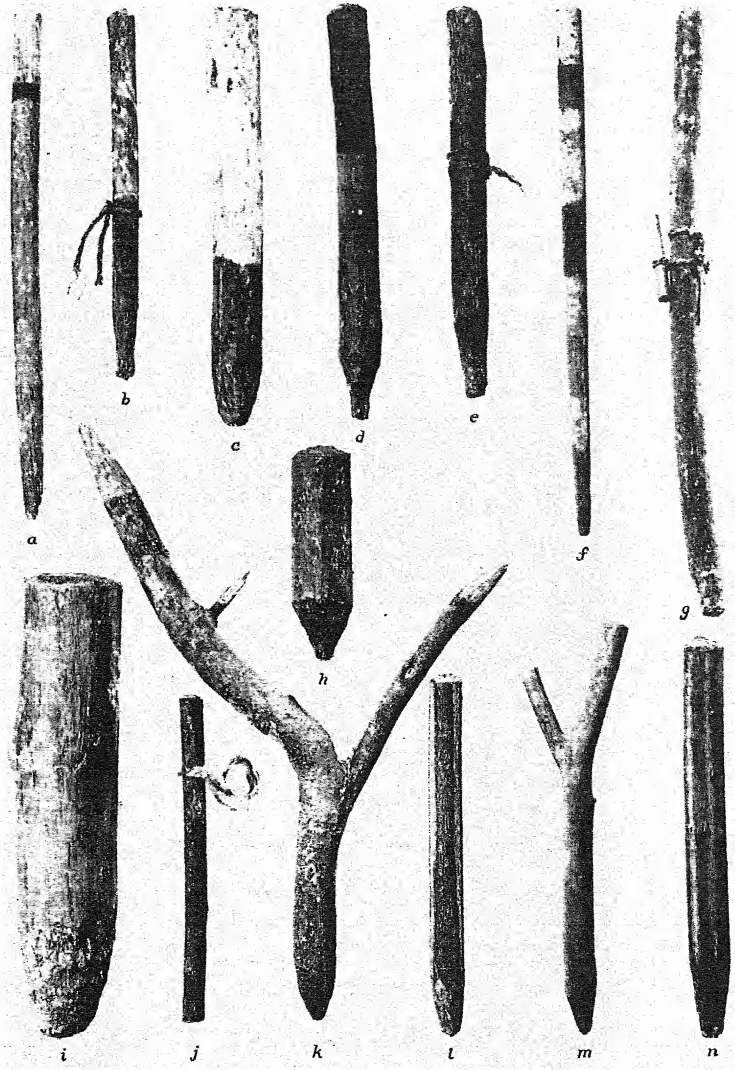


FIG. 119

FIG. 118. UNPEELED TWIG PAHOS. *a*, *i*, Steamboat Cave; *b-f*, Doolittle Cave; *g*, *h*, *j*, *l*, Ceremonial Cave; *k*, Gila National Monument. *a*, with large quill; *b*, human-hair cord; wrappings of stripped yucca leaves and yucca-fiber cords hold a grass-stem paho and wisp of cornhusk (*i*) or quills showing that feathers had been tied to them. (See p. 125.) *a*, 13¼ inches long.

FIG. 119. STUB PAHOS. *a*, *c*, *f*, *k*, *l*, *n*, Steamboat Cave; *b*, *d*, *e*, *g*, *j*, Mule Creek Cave; *h*, *i*, Cave 1, Goat Basin; *m*, Greenwood Cave. *b*, *e*, *g*, have wrappings of cotton cord (wrapping on *g* holds a reed cigarette); *k*, *m*, forked pahos, unusual; *l*, strips of bark left on for decoration. (See pp. 125–26.) *i*, 2¼ inches in diameter and 10¼ inches long. (See pp. 131–32, for miniature stub pahos.)

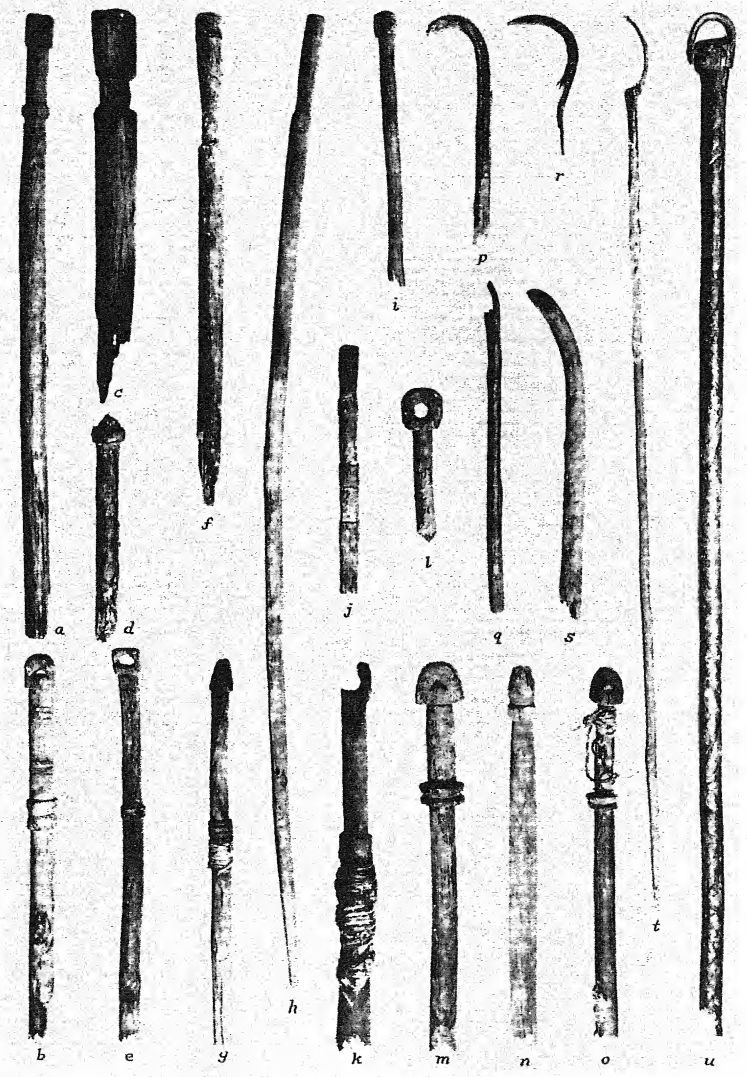


FIG. 120

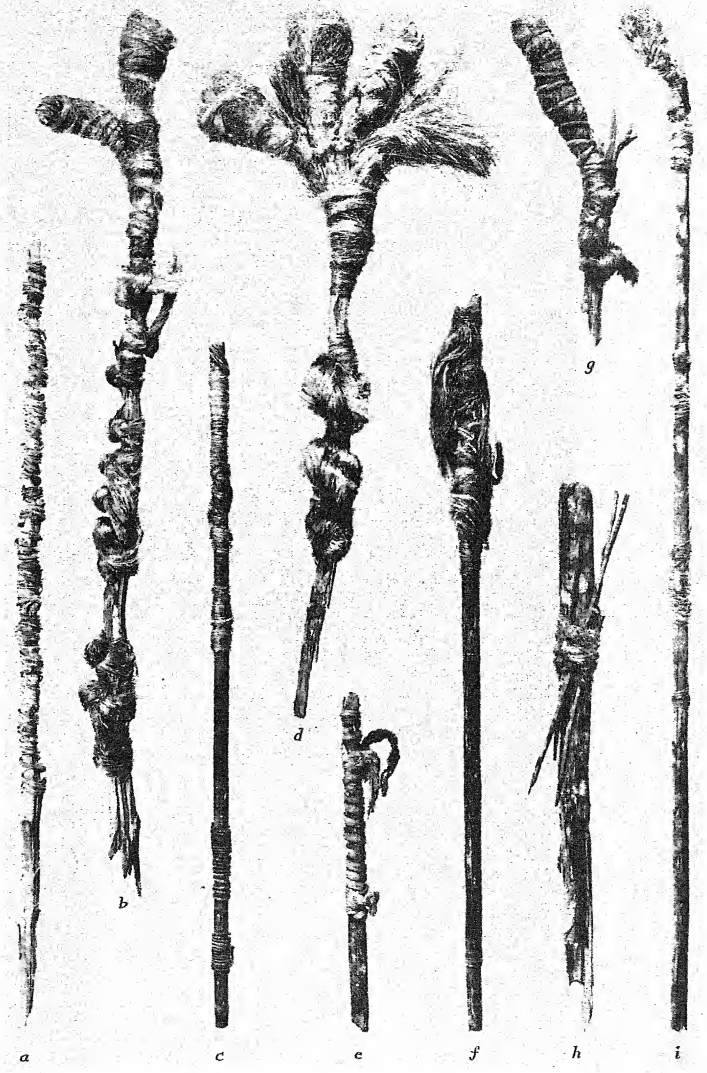


FIG. 121

FIG. 120. CROOK- AND ROUNDEL-STAFF PAHOS. *a-e*, *g*, *k-m*, *o*, *u*, Mule Creek Cave; *f*, *h*, *n*, Greenwood Cave; *i*, *q*, *s*, Doolittle Cave; *j*, *p*, *t*, Steamboat Cave; *r*, Cave 1, Goat Basin. *a-o*, roundel-staff pahos (p. 128); *p-u*, crook-staff pahos; all fragmentary but *t* (upper part painted green; lower part, red); *u*, shows burned design in diamonds with serrated edges (p. 127). Some of the roundel-staff pahos are painted and have cord wrappings which have held feathers. *u*, 23 inches long.

FIG. 121. DART AND STALK PAHOS IN CEREMONIAL CAVE. Pahos of sotol bloom stalks and atlatl darts with fiber bolls attached; fiber bolls contain tobacco; hair ornament attached to *h*. (See pp. 128–29.) *b*, 20 inches long; originally the pahos were much longer.

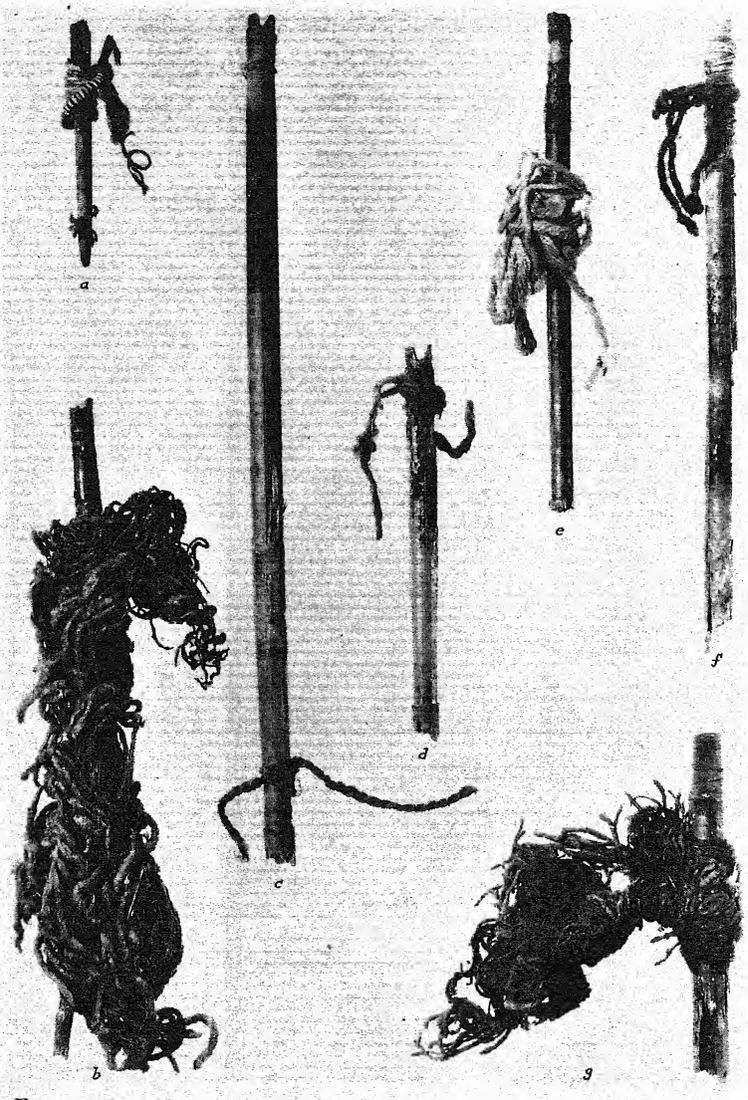


FIG. 122

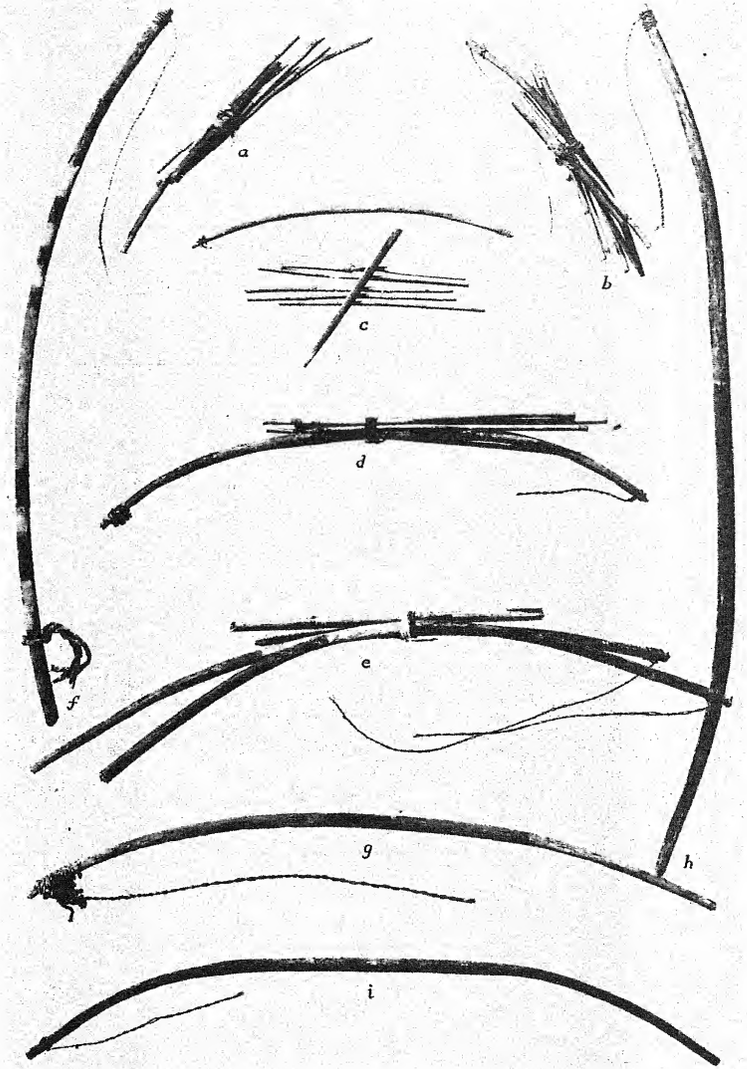


FIG. 123

FIG. 122. ARROW PAHOS. *a*, *b*, *d-g*, Mule Creek Cave; *c*, Cave 1, Goat Basin. Loose strands of soft cotton cord attached to pahos (cord on *a* strung through discoidal beads). (See pp. 129–30.) *c*, 8⅝ inches long.

FIG. 123. MINIATURE CEREMONIAL BOWS. *a-c*, Steamboat Cave; *d-i*, Mule Creek Cave. *a-c*, bow sets, tiny bows with painted-stub paho and grass-stem pahos attached with cotton cord; *d*, larger set, attached grass-stem pahos; *e*, still longer bows, grass stems heavy enough to suggest arrows instead of pahos; *f-i*, painted solid colors or banded. (See pp. 130–31, for *f-i*; pp. 131–32, for *a-e*.) *h*, 19¼ inches long.

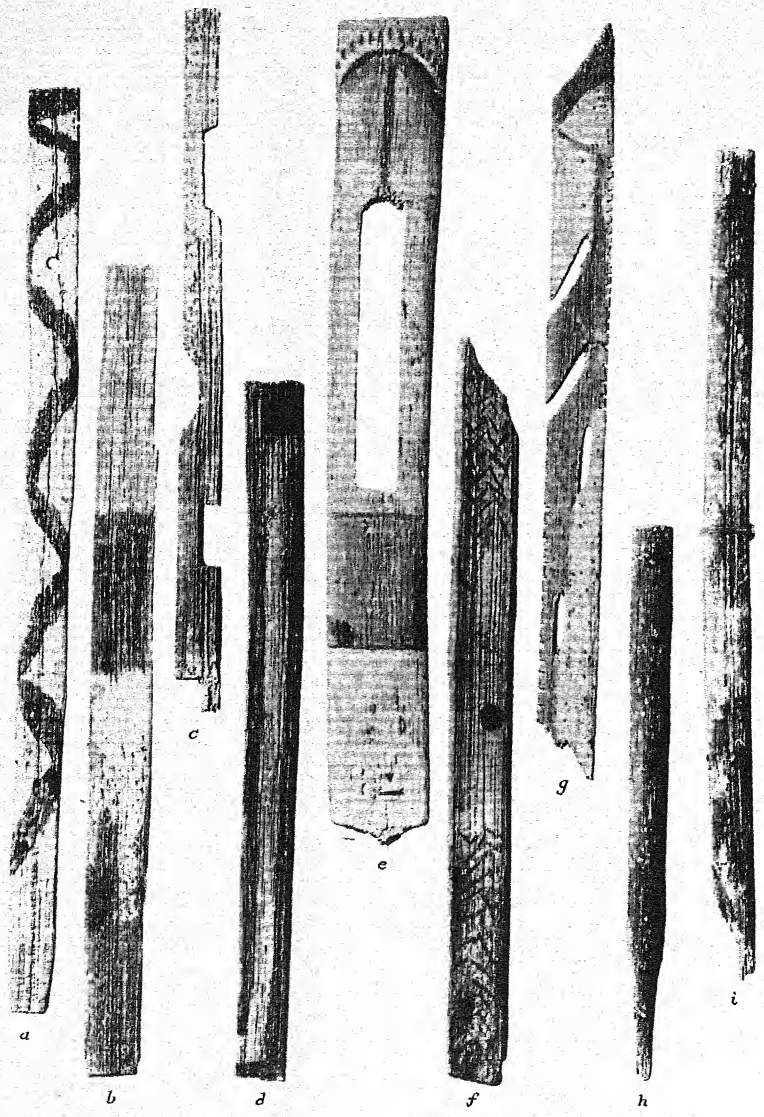


FIG. 124

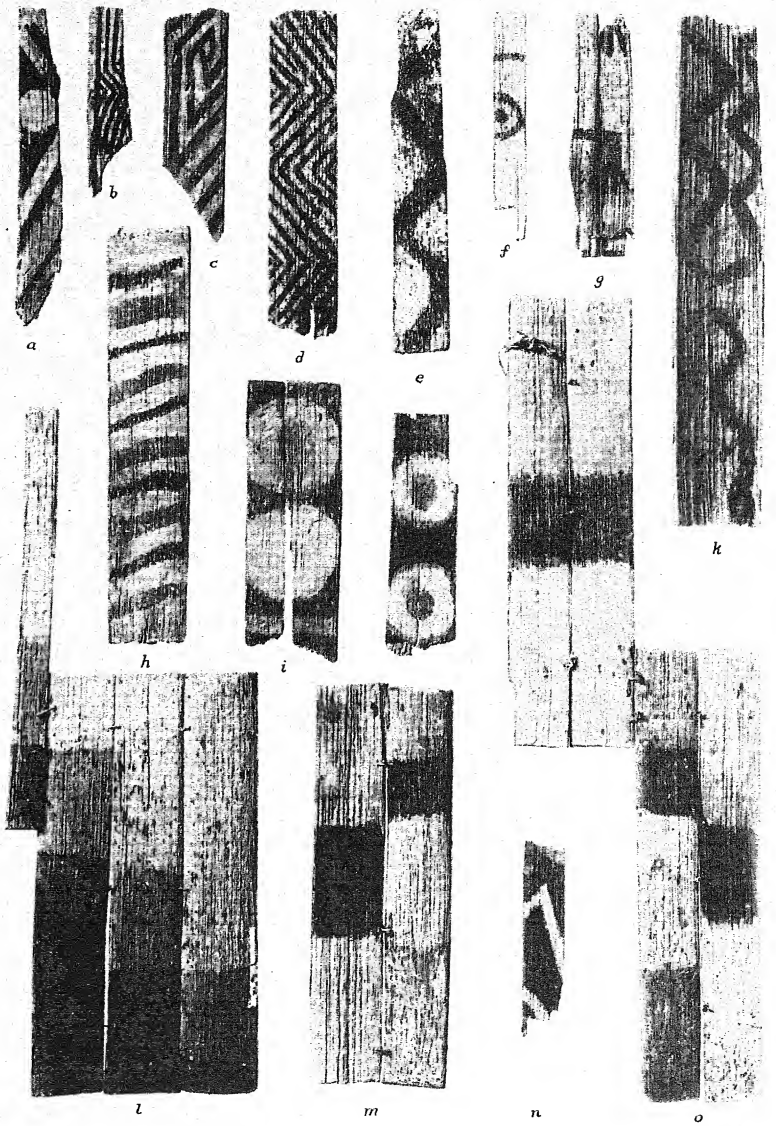


FIG. 125

FIG. 124. SPLIT-STICK WANDS. *a-c*, *e*, *g*, *h*, Steamboat Cave; *d*, Cave 8, Hueco Mountains; *f*, Site 3, Gila River, cave above Shelley Canyon; *i*, Mule Creek Cave. (For decorative scheme and color combinations, see p. 132.) *a*, 15¼ inches long.

FIG. 125. WOODEN TABLITAS. *a*, Doolittle Cave; *b-f*, *i*, *j*, *l-o*, Steamboat Cave; *g*, Mule Creek Cave; *h*, *k*, Ceremonial Cave. (For decorative scheme and color combinations, see pp. 132–34.) *k*, 7½ inches long.

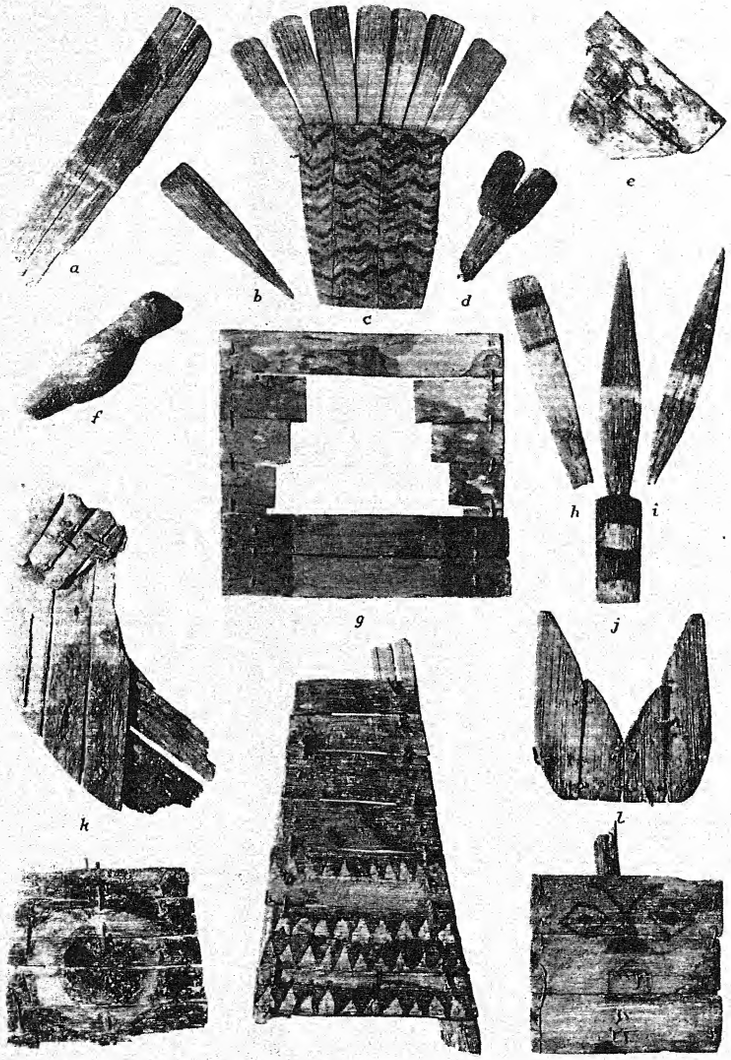


FIG. 126

FIG. 127

FIG. 126. WOODEN TABLITAS AND BIRD. *a*, *d-f*, Doolittle Cave; *b*, *c*, *g-j*, *l*, *o*, Mule Creek Cave; *k*, Lone Mountain Cave; *m*, Cave 7, Hueco Mountains; *n*, Cave 5, Hueco Mountains. Complete and fragmentary painted specimens, some of them wings, feathers, and flower petals. (For decorative scheme and color combinations, see pp. 132–35.) *n*, 9¾ inches long.

FIG. 127. LEATHER POUCHES. *a*, *d*, Chavez Cave; *b*, *f*, Ceremonial Cave; *c*, Steamboat Cave; *e*, Basket-maker burial in Cave 1, Hueco Mountains. *b*, whole rodent skin, legs tied with fiber; *d*, pouch made from neck skin of antelope; *e*, contains cornmeal. (See p. 136.) *d*, 11⅜ inches long.

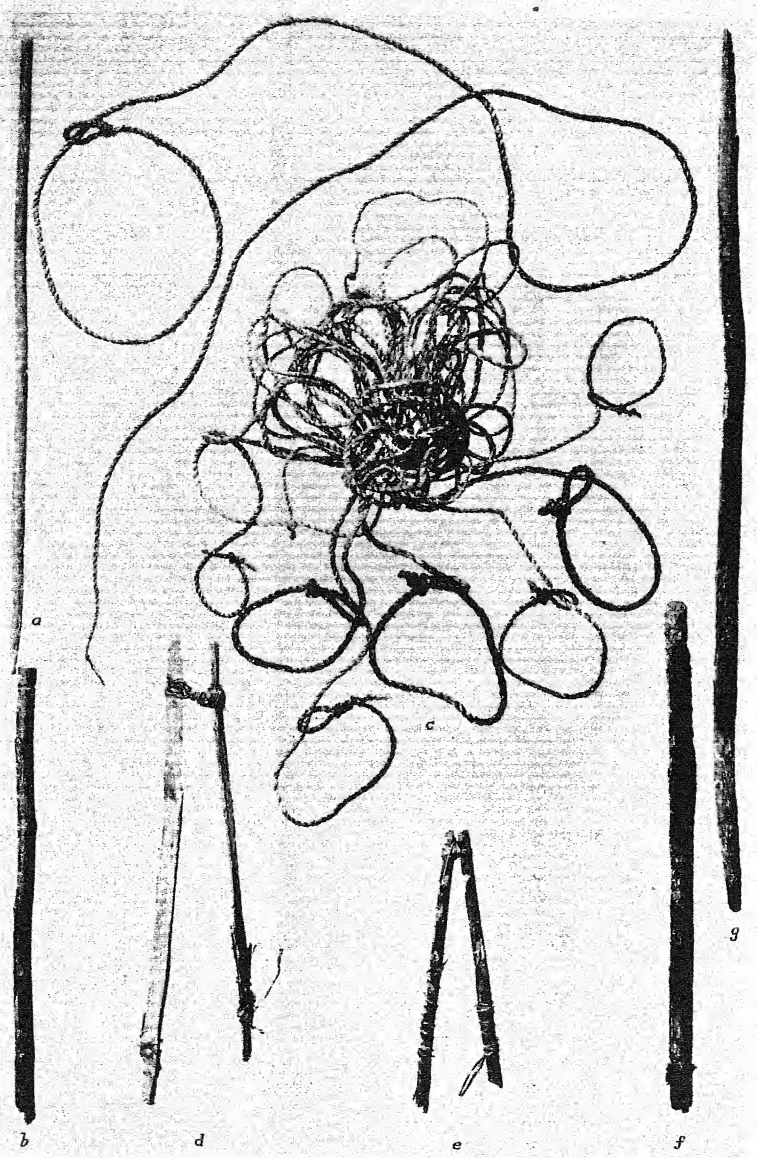


FIG. 128

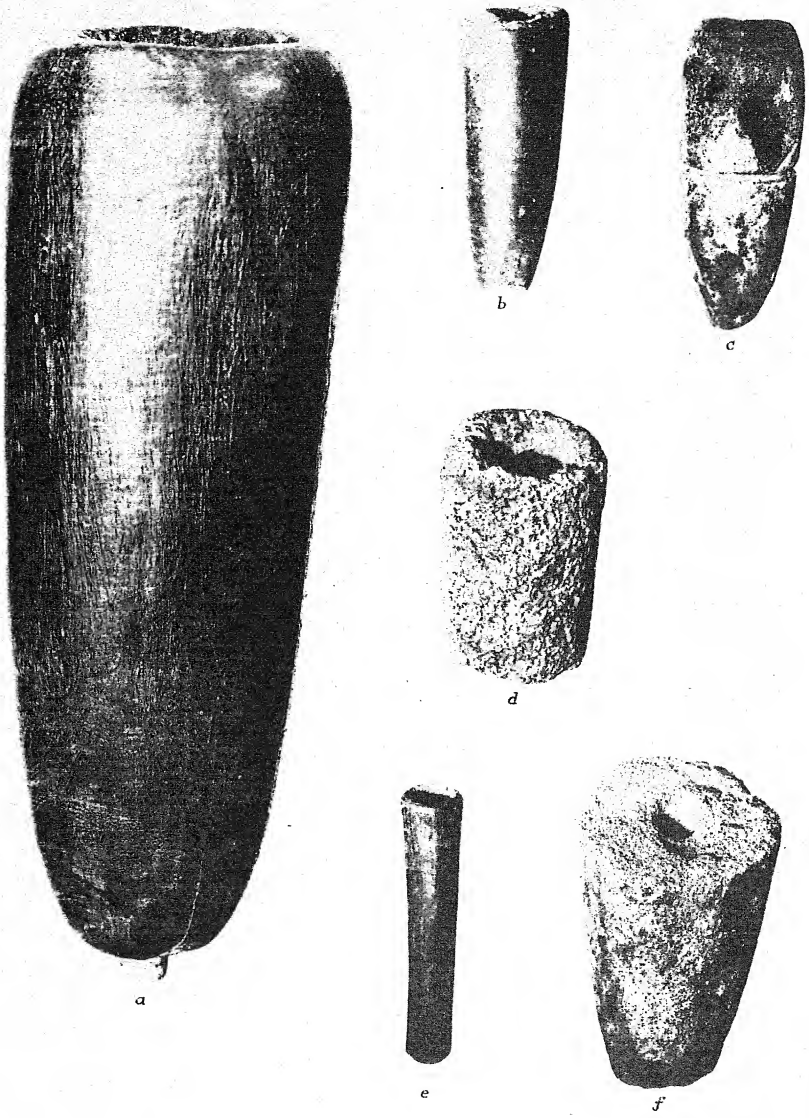


FIG. 129

FIG. 128. SNARES. *a*, *b*, *g*, Doolittle Cave; *c*, *f*, Chavez Cave; *d*, *e*, Ceremonial Cave. *b*, *d-f*, hinged-stick snares; *c*, bundle of string snares. (See pp. 136–38.) *g*, 16 inches long.

FIG. 129. PIPES. *a*, Steamboat Cave; *b-d*, Ceremonial Cave; *e*, Cave 1, Middle Fork of Gila River; *f*, Doolittle Cave. *a*, of native walnut; *b-d*, Basket-maker; *e*, black and tubular bone; *f*, painted fragment, Pueblo III. (See pp. 140–41.) *a*, 8 inches long.

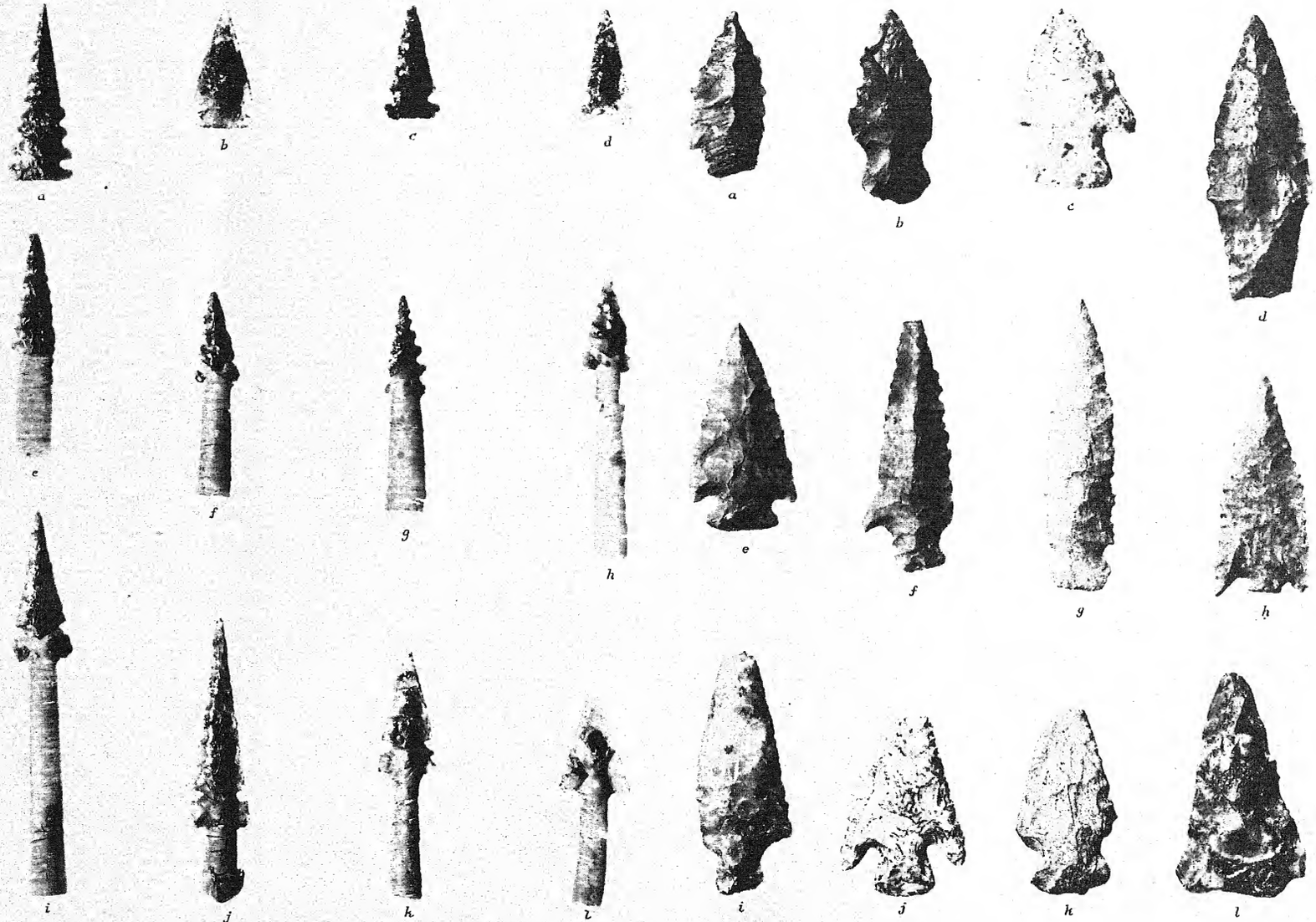


FIG. 130

FIG. 131

FIG. 130. OBSIDIAN PROJECTILE POINTS. *a-d, f, i-l*, Mule Creek Cave; *e, g, h*, Steamboat Cave. Sinew whipping shows method of attachment to arrow foreshafts. (See p. 141.) *a*, 1¼ inches long.

FIG. 131. STONE PROJECTILE POINTS. *a, b, d, f, g*, Ceremonial Cave; *c*, Cave 1, Hueco Mountains; *e*, Chavez Cave; *h, k*, Cave 1, Middle Fork of Gila River; *i, j*, Steamboat Cave; *l*, Doolittle Cave. *a, f*, found with Hueco Basket-maker skeleton in burial. (See p. 141.) *g*, 2⅜ inches long.

FIG. 132

FIG. 132. STONE KNIVES. *a*, *c*, Cave 1, Hueco Mountains; *b*, Deer Creek Cave; *c*, Steamboat Cave; *d*, Doolittle Cave; *f*, Cave 2, Playas district; *g*, Cliff House 2, West Fork of Gila River. (See p. 141.) *e*, 5⅜ inches long.

FIG. 133

FIG. 133. STONE SCRAPERS AND ARROW STRAIGHTENERS. *a*, *b*, Doolittle Cave; *c*, Ceremonial Cave; *d*, Steamboat Cave; *e*, Mule Creek Cave; *f*, *h*, Sipe Canyon Cave; *g*, Cliff House 1, West Fork of Gila River. (See p. 142.) *d*, 4 inches long.

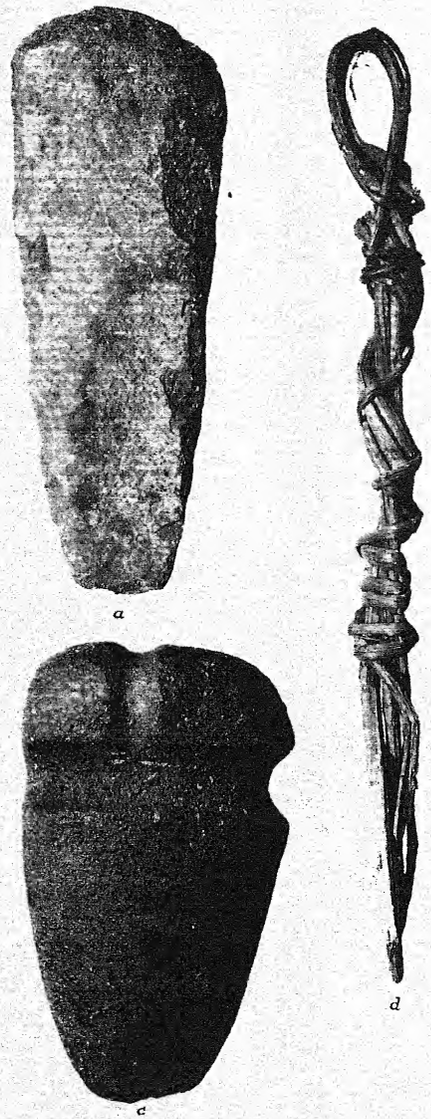


FIG. 134

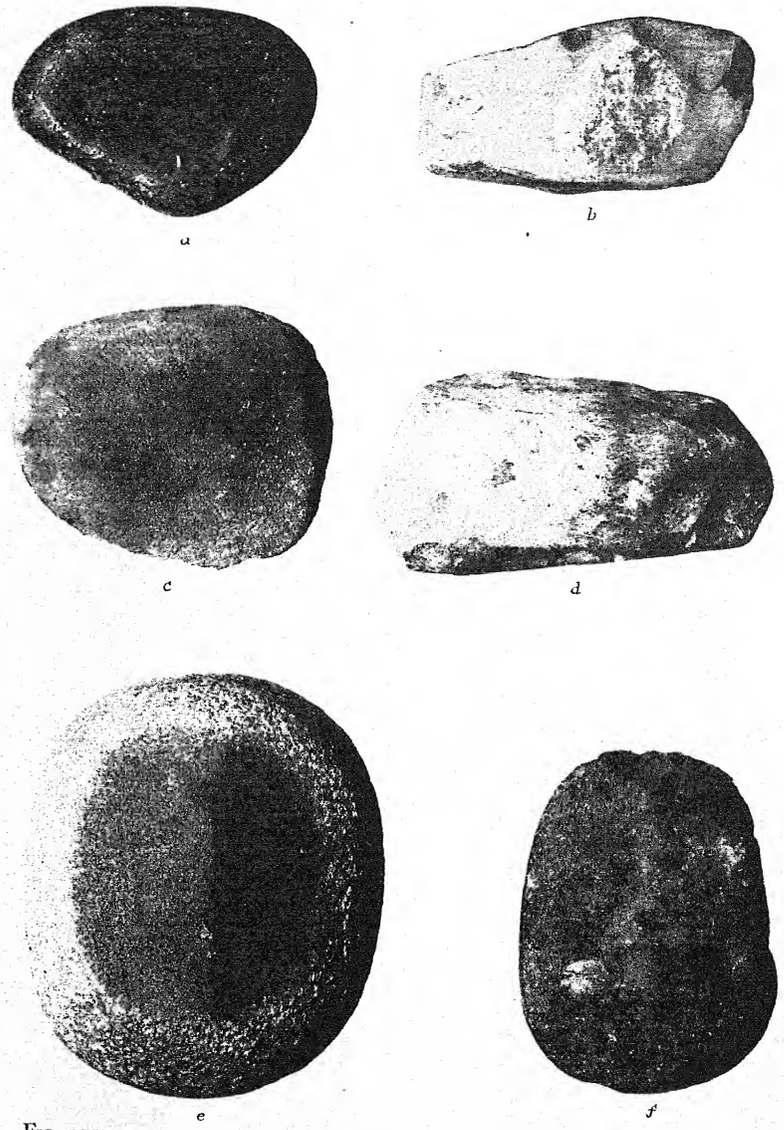


FIG. 135

FIG. 134. STONE HOE AND AXES. *a*, *e*, Doolittle Cave; *b*, Cave 1, Hueco Mountains; *c*, *d*, Chavez Cave. *a*, stone hoe; *c*, stone axe — both Pueblo III; *b*, *e*, fist axes, Basket-maker; *d*, hafting for stone tool. (See pp. 142–43.) *d*, 11¾ inches long.

FIG. 135. RUBBING STONES. *a*, Steamboat Cave; *b*, *d*, *e*, Chavez Cave; *c*, *f*, Ceremonial Cave. *e*, double-beveled-face rubbing stone. (See p. 143.) *e*, 5¾ inches long.

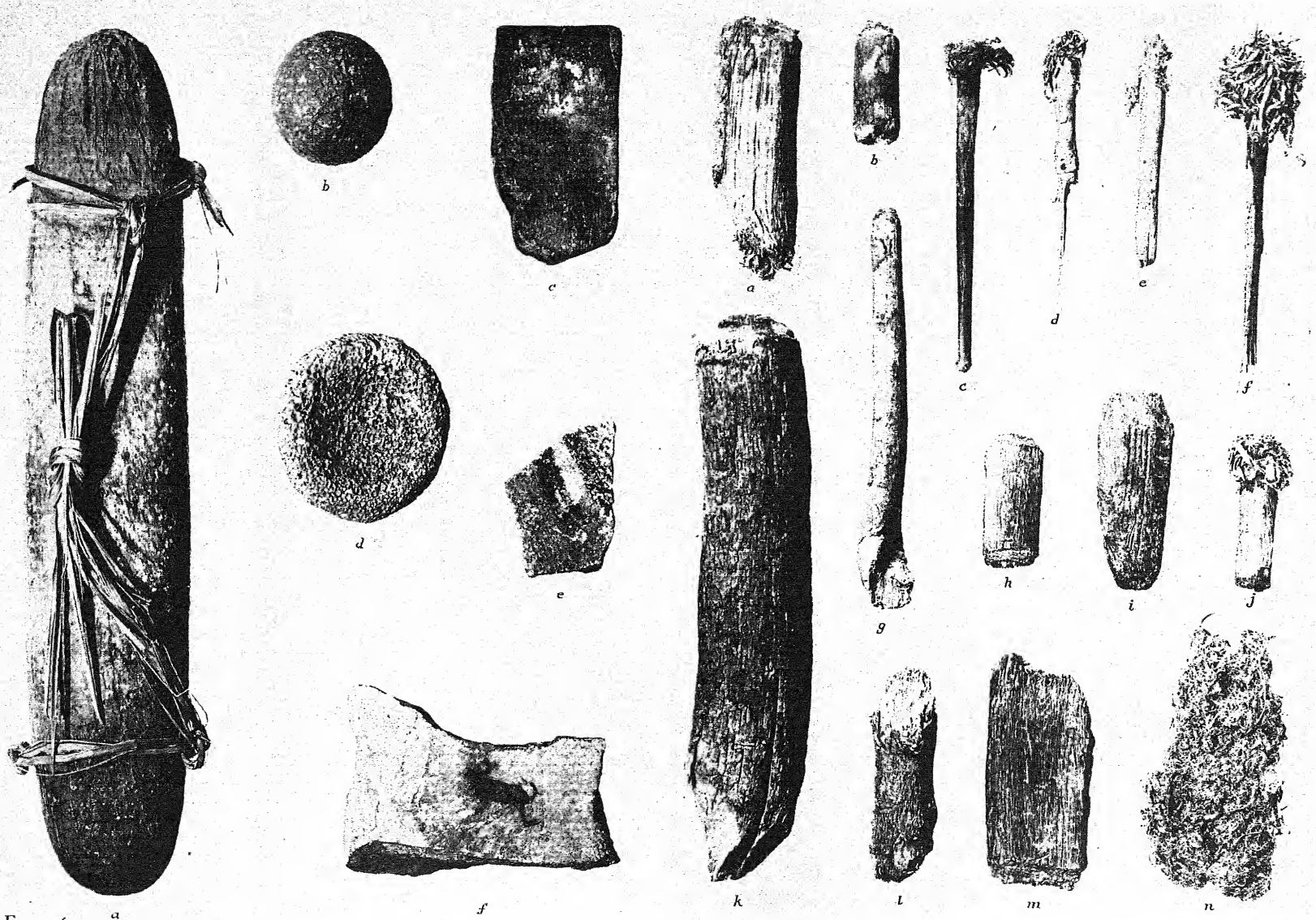


FIG. 136

FIG. 137

FIG. 136. STONE ARTIFACTS. *a*, Ceremonial Cave; *b*, *d*, Chavez Cave; *c*, *e*, Doolittle Cave; *f*, Cave 1, Hueco Mountains. *a*, pestle with yucca-leaf carrying strap; *b*, ball; *c*, stone tablet or plaque; *d*, small pigment mortar; *e*, *f*, painted stones. (See p. 143.) *a*, 13½ inches long.

FIG. 137. WOODWORKING. *a*, Picture Cave; *b*, *g*, *h*, *i*, *k-n*, Ceremonial Cave; *c*, Cave 1, Middle Fork of Gila River; *d*, *f*, Sipe Canyon Cave; *e*, Steamboat Cave; *j*, Kelly Cave. Illustrating the results of cutting and chopping with stone tools. (See p. 144.) *k*, 9¾ inches long.

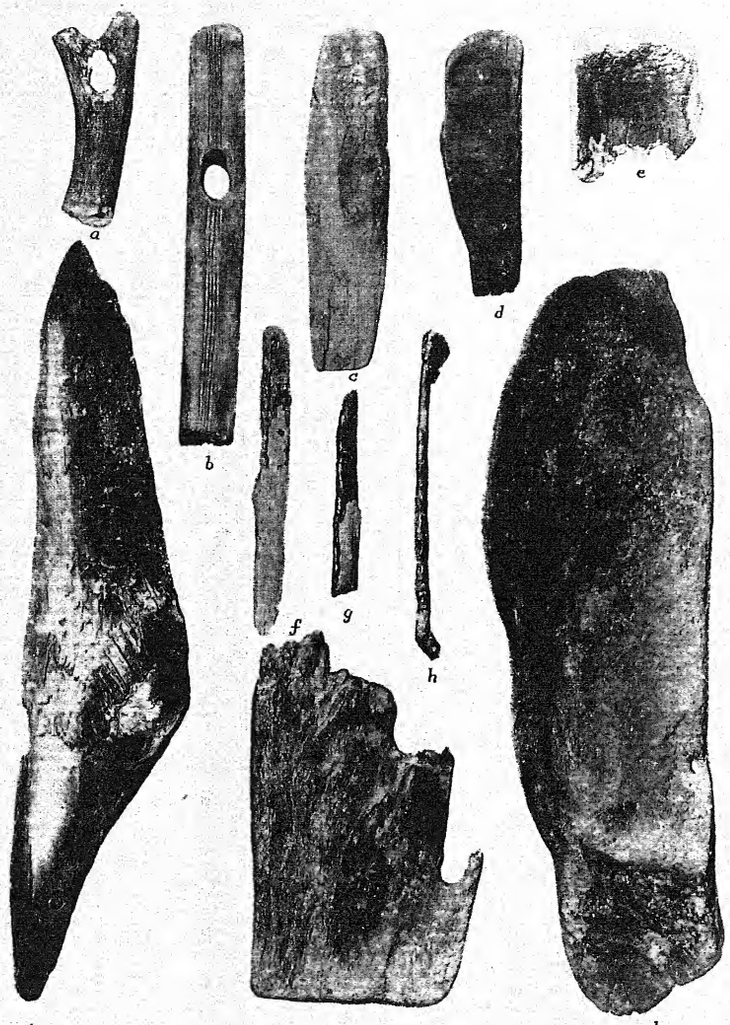


FIG. 138

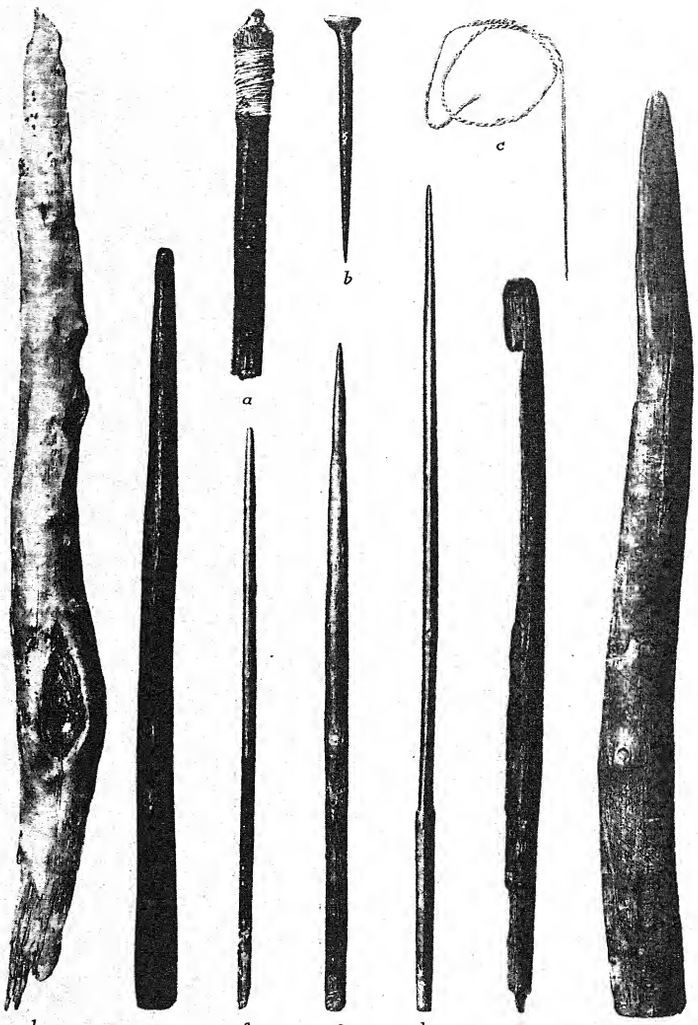


FIG. 139

FIG. 138. HORN AND WOODEN ARTIFACTS. *a*, *c*, Chavez Cave; *b*, *d*, Ceremonial Cave; *e*, Cave 5, Hueco Mountains; *f-h*, Cave 7, Hueco Mountains; *i*, Kelly Cave; *j*, Deer Creek Cave; *k*, Cave 6, Hueco Mountains. *a*, *b*, dart wrenches; *c*, *d*, *i*, *k*, tree-shell trowels; *e*, fragment of wooden ladle; *f-h*, pitch daubers; *j*, board of unknown use. (See pp. 144–46). *i*, 17½ inches long.

FIG. 139. SMALL WOODEN TOOLS. *a*, Kelly Cave; *b*, *i*, Cave 1, Middle Fork of Gila River; *c*, *d*, *f*, *g*, *j*, Ceremonial Cave; *e*, Chavez Cave; *h*, Cave 9, Hueco Mountains. *a*, hafted tool of unknown use; *b*, *e-h*, awls; *c*, yucca spine needle; *d*, *j*, spatulate tools; *i*, suggests crochet hook. (See p. 146.) *d*, 10⅜ inches long.

FIG. 140

FIG. 141

FIG. 140. FIRE-MAKING APPARATUS. *a, b, e, g,* Doolittle Cave; *c,* Chavez Cave; *d, f, i, j,* Ceremonial Cave; *h,* Mule Creek Cave; *k,* Steamboat Cave. *a-d* revolve between hands; *e-j,* hearths; *j,* hearth, distal end of dart; *k,* cedar-bark torch. (See pp. 146–48.) *a,* 20½ inches long.

FIG. 141. PLANTING STICKS. *a, e, f, g,* Chavez Cave; *b-d, h-j,* Mule Creek Cave. *a,* incised; *b,* with cotton-string wrapping holding a quill; *c,* with banded bark; *d,* with whipping of cotton cord, no doubt prayer offering for bountiful crops; *e* shows mud still adhering to the blade; *j,* larger stick with painted decoration, no doubt prayer offering. (See pp. 148–49.) *e,* 54¾ inches long.

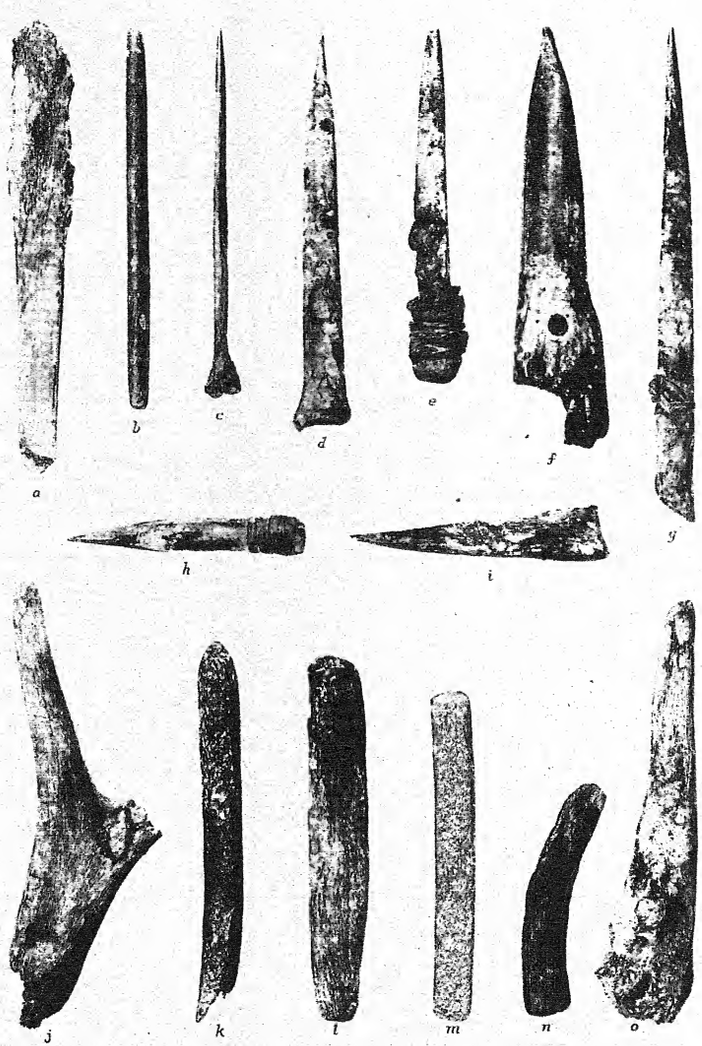


FIG. 142

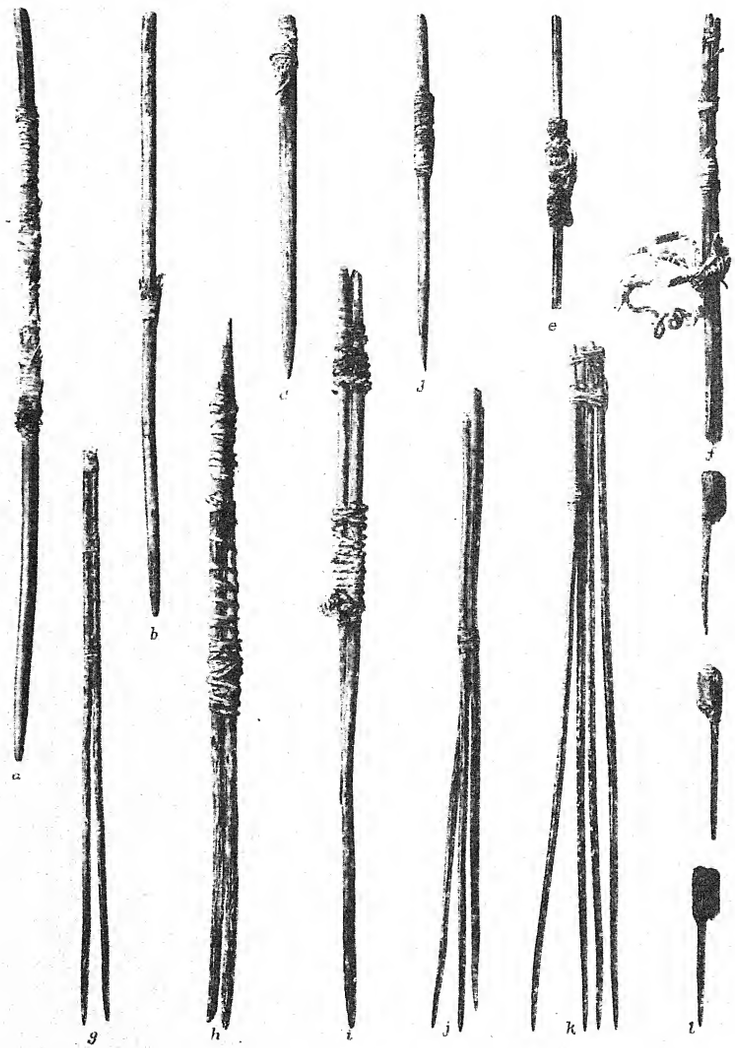


FIG. 143

FIG. 142. BONE TOOLS. *a*, *h*, Chavez Cave; *b*, *m-o*, Steamboat Cave; *c*, Cave 6, Hueco Mountains; *d*, *e*, *g*, *l*, Ceremonial Cave; *f*, *j*, Doolittle Cave; *i*, Brushy Mountain Cave; *k*, Mule Creek Cave; *n*, Kelly Cave. *a*, *b*, weaving tools; *c-i*, awls: *e*, *h*, with padded ends, typically Basket-maker; *j-o*, flaking tools (*j*, antler); *l-n*, flattened tools, were to be hafted with long stick. (See pp. 149–50.) *j*, 5 inches long.

FIG. 143. HAIR ORNAMENTS AND WOODEN PINS. *a*, Cave 6, Hueco Mountains; *b*, *l*, Steamboat Cave; *c-e*, *g-k*, Ceremonial Cave; *f*, Doolittle Cave. *a-k*, Basket-maker hair ornaments, of 1 to 4 polished prongs with whippings of fiber or sinew which still hold the quills of downy feathers (*i*, double-prong) (pp. 150–51); *l*, wooden pins, unusual and found in only 2 sites (p. 150). *i*, 10 5/16 inches long.

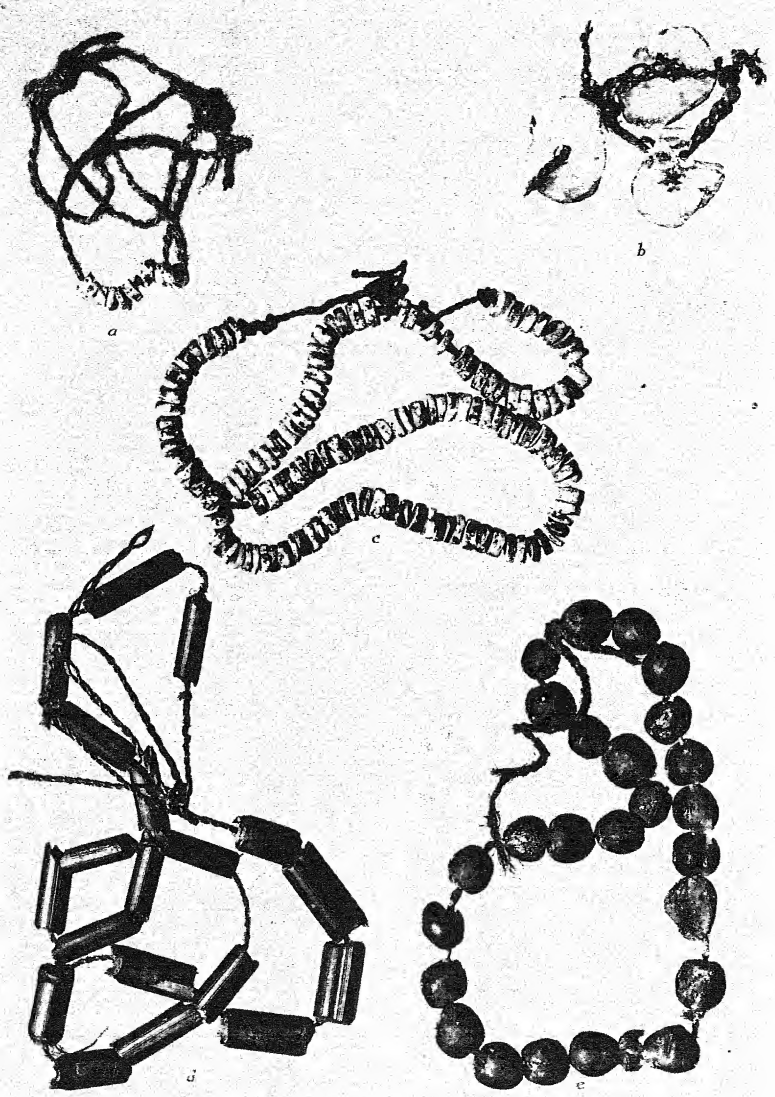


FIG. 144

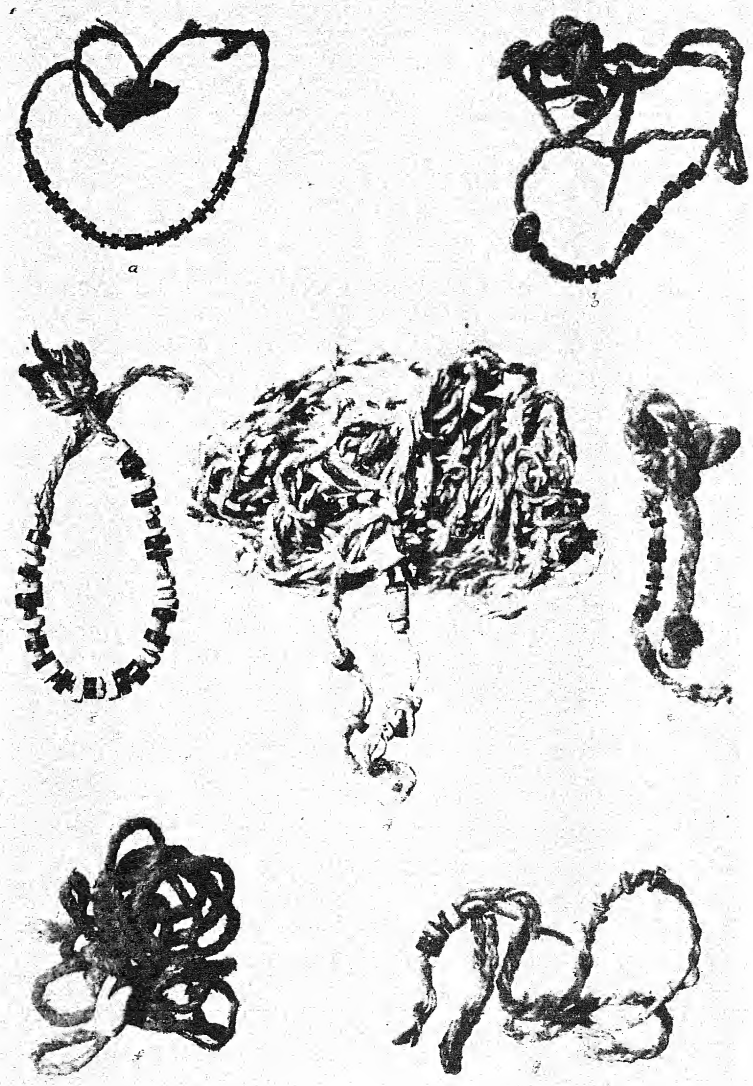


FIG. 145

FIG. 144. BEADS FROM THE HUECO AREA ON ORIGINAL STRING. *a*, *c*, *d*, Chavez Cave; *b*, *e*, Ceremonial Cave. *a*, discoidal shell beads on hair string; *b*, gypsum discs on yucca-fiber cord; *c*, discoidal shell beads on yucca-fiber cord; *d*, pieces of reed sectioned by glowing ember and strung on yucca-fiber cord; *e*, seeds strung on yucca-fiber cord. (See pp. 151–52.) Beads, slightly less than actual size.

FIG. 145. BEADS FROM UPPER GILA AREA. *a-c*, *e*, *f*, *g* (4-bead strand), Mule Creek Cave; *d*, Steamboat Cave; *g* (3-bead strand), Doolittle Cave. Discoidal turquoise, black and white stone beads and an occasional *olivella* shell, bone, or turquoise pendant strung on soft cotton cord. Specimens originally had been attached to pahos. (See pp. 151–52.) Loop of *c*, 2¾ inches long.

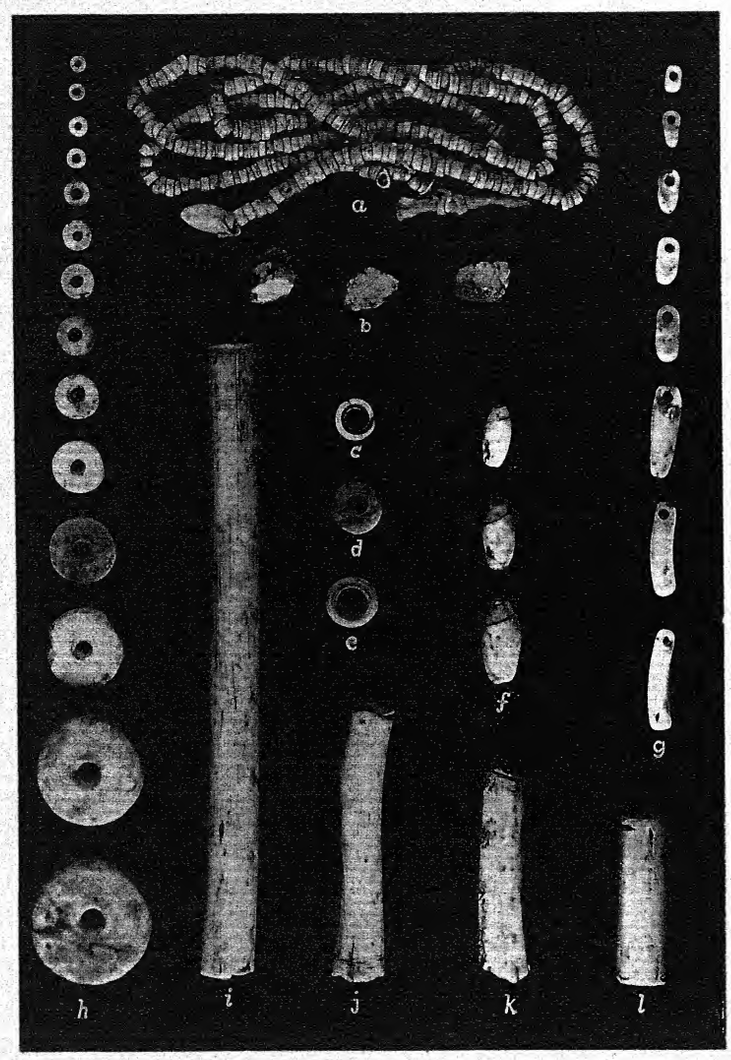


FIG. 146

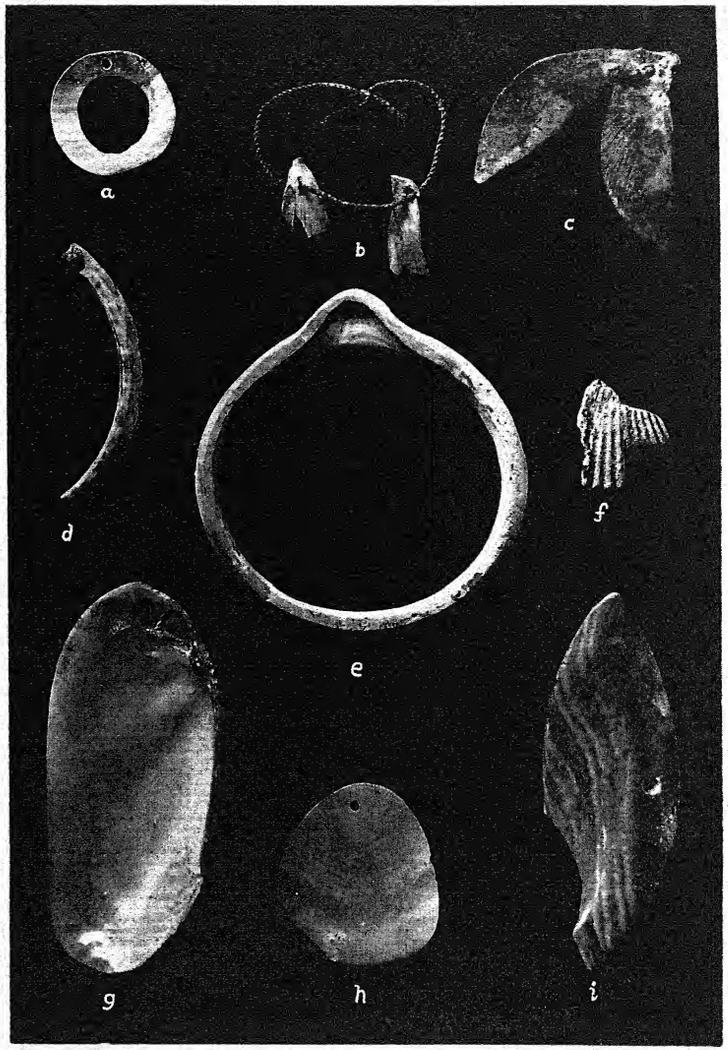


FIG. 147

FIG. 146. BEADS AND PENDANTS. *a*, *b*, Cave 8, Hueco Mountains; *c*, Chavez Cave; *d*, Mule Creek Cave; *e*, *l*, Doolittle Cave; *f-k*, Ceremonial Cave. *a*, discoidal shell, end shows original cotton string through 2 beads; *b*, pieces of turquoise matrix with polished faces; *c*, end of conus shell; *d*, pink *spondylus* shell; *e*, hemispherical stone; *f*, *olivella* shell; *g*, small stone pendants; *h*, range in size of white stone beads; *i-l*, bone beads, rare. (See pp. 151–52.) *i*, 5⅛ inches long.

FIG. 147. BRACELET AND PENDANTS. *a*, *d*, Mule Creek Cave; *b*, Chavez Cave; *c*, *g*, *h*, Ceremonial Cave; *e*, Lone Mountain Cave; *f*, Doolittle Cave; *i*, Cave 2, West Fork of Gila River. *a*, *g*, and *h*, fresh-water mussel shell pendants; *b*, *c*, opercular fish bones on original yucca-fiber cords (bones of *c*, tinted red); *d*, pendant from broken shell bracelet; *e*, *glycimeris* shell bracelet; *f*, fluted shell bird form; *i*, pink spondylus shell pendant. (See p. 152.) *g*, 3 3/16 inches long.

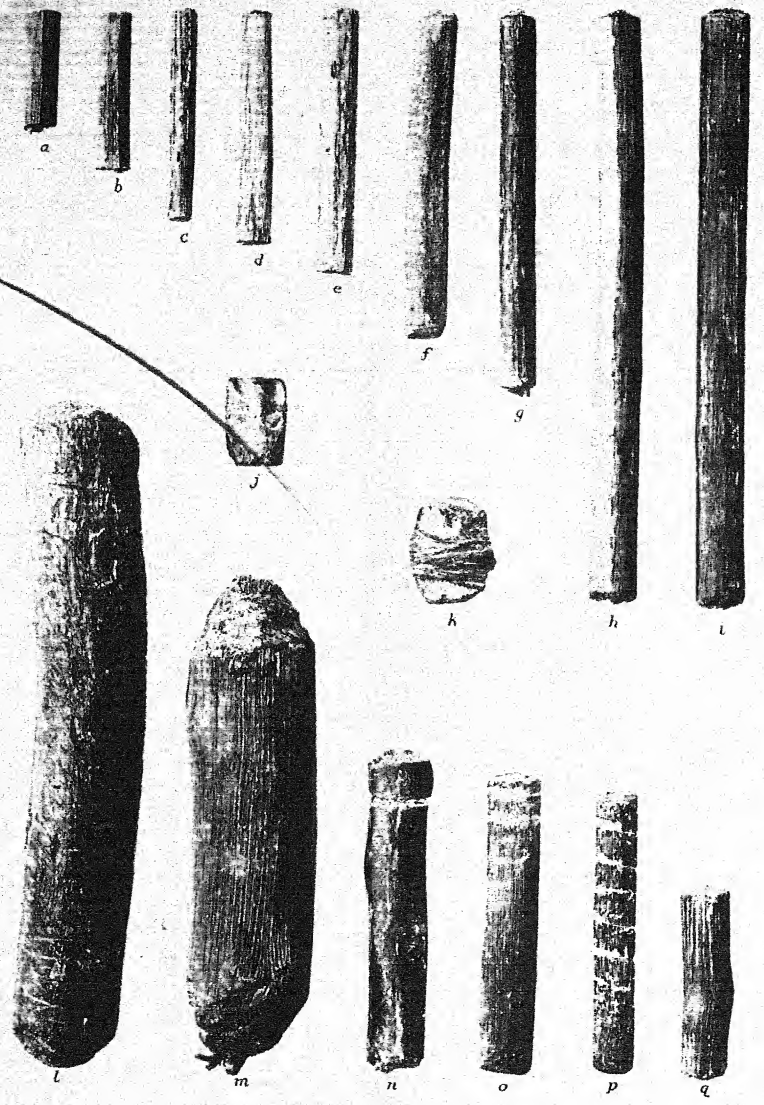


FIG. 148

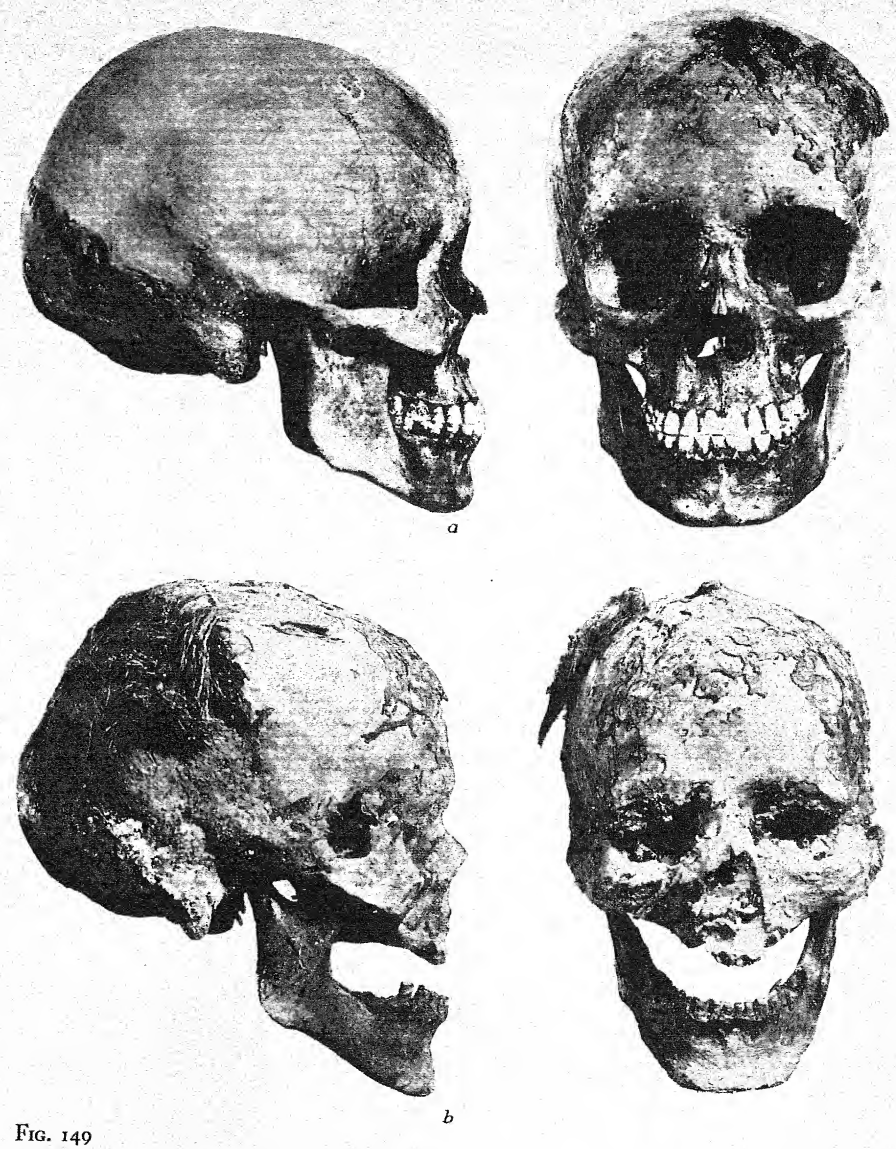


FIG. 149

FIG. 148. GAMING STICKS OR COUNTERS AND BONE DICE. *a-i*, *n*, *q*, Steamboat Cave; *j*, *k*, Doolittle Cave; *l*, Chavez Cave; *m*, Ceremonial Cave; *o*, *p*, Cave 1, Middle Fork of Gila River. *j*, single die (p. 153); *k*, pair of bone dice, bound together with yucca-fiber cord (p. 153). *l*, 4 7/8 inches long. (For coloring of gaming sticks, see pp. 152–53.)

FIG. 149. *a*, Cranium of skeleton from Ceremonial Cave, Hueco Mountains (p. 161); *b*, cranium of skeleton from Cave 1, Hueco Mountains (p. 162).